

Educational Aims

- To provide recommendations for conducting field walking tests in people with chronic respiratory disease, from the new European Respiratory Society/American Thoracic Society Technical Standard
- To provide information to assist in selecting a field walking test in people with chronic respiratory disease.

Key points

- The 6MWT, ISWT and ESWT are valid and reliable tests of functional exercise capacity in people with COPD. The 6MWT is also widely used in other chronic respiratory disorders.
- There is a learning effect for the 6MWT and ISWT, so two tests must be performed if the tests are being used to measure change over time, with the best distance recorded.
- The 6MWT is very sensitive to changes in the way it is conducted, including use of encouragement, provision of supplemental oxygen, changes in track layout and length, and use of wheeled walkers. These factors should be held constant when the test is repeated.
- The 6MWT, ISWT and ESWT are strenuous tests, with cardiorespiratory responses that are similar to those during a maximal incremental exercise test. As a result, the contraindications and precautions for these field walking tests should be the same as for a laboratory-based incremental exercise test.



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How to carry out a field walking test in chronic respiratory disease



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Summary

The European Respiratory Society (ERS) and American Thoracic Society (ATS) have recently published a Technical Standard which documents the standard operating procedures for the 6-min walk test (6MWT), incremental shuttle walk test (ISWT) and endurance shuttle walk test (ESWT). The Technical Standard shows that all three tests are valid and reliable measures of functional exercise capacity in people with chronic respiratory disease and makes recommendations for standardising their performance. Key findings and recommendations of the Technical Standard include:

- The 6MWT, ISWT and ESWT are strenuous tests which elicit cardiorespiratory responses that are similar to those observed during a maximal incremental exercise test. As a result, the contraindications and precautions for field walking tests should be consistent with those used for a laboratory-based incremental exercise test.
- There is strong evidence of a learning effect for the 6MWT and ISWT. Two tests should be performed when the 6MWT or ISWT are used to measure change over time.
- The 6MWT, ISWT and ESWT are responsive to treatment effects in people with chronic respiratory disease, particularly for rehabilitation.
- The 6MWT is very sensitive to variations in methodology, including use of encouragement, provision of supplemental oxygen, changes in track layout and length, and use of wheeled walkers. These factors should be documented and held constant on repeat testing.
- The lowest S_{pO_2} recorded during a 6MWT is an important marker of disease severity and prognosis. Continuous pulse oximetry is recommended during the 6MWT, to ensure that the lowest S_{pO_2} is recorded.
- In adults with chronic respiratory disease, a change in 6-min walk distance of 30 m or more indicates a clinically significant change has occurred.

Conflict of interest
None declared.



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HERMES syllabus link:
module D.1.6

Introduction

The 6-min walk test (6MWT) is often used to measure functional exercise capacity, assess prognosis and evaluate response to treatment across a wide range of chronic respiratory diseases. The incremental shuttle walk test (ISWT) and endurance shuttle walk test (ESWT) are newer tests of functional exercise capacity that are increasing in popularity, particularly in COPD. The last 10 years has seen a growing body of research describing the use and properties of these three tests. As a result the European Respiratory Society (ERS) and American Thoracic Society (ATS) have together developed a new Technical Standard, to provide clinicians and researchers with guidance on evidence-based, standardised testing procedures for adults with chronic respiratory disease [1]. The Technical Standard provides information on the practical aspects of conducting field walking tests in a safe, effective and reproducible manner. The testing procedures described in this article are taken from the new Technical Standard.

The 6-min walk test

The 6MWT is a self-paced test of walking capacity. Patients are asked to walk as far as possible in 6 min along a flat corridor. The distance in metres is recorded. Standardised instructions and encouragement are commonly given during the test. The main outcome is the 6-min walk distance (6MWD). The 6MWD is a valid and reliable measure of functional exercise capacity across a wide range of chronic respiratory disorders. The distance walked is strongly related to measures of peak exercise performance and moderately related to physical activity in daily life [2]. In COPD, people with a lower 6MWD are more likely to be admitted to hospital and have an increased mortality risk [2].

Although the 6MWD is a reliable measure in people with chronic respiratory disease, recent studies show strong evidence of a learning effect when two or more tests are conducted. In patients with COPD, there is an average improvement of 26 m on the second test [2]. Less data are available in other patient groups, however the available studies support a learning effect across all chronic respiratory diseases [2]. The effect of learning on the 6MWD is large enough to be clinically

important when the 6MWT is used to evaluate response to treatment or change over time. As a result, the Technical Standard recommends that in these circumstances two 6MWTs should be performed and the best 6MWD recorded. One test may also be sufficient for patients who have recently performed the test, where the learning effect is smaller (*e.g.* end of pulmonary rehabilitation) [3].

Exercise-induced desaturation on a 6MWT provides important clinical information as it has been associated with reduced daily physical activity, faster forced expiratory volume in 1 s (FEV₁) decline and worse prognosis [4, 5]. It may also guide provision of supplemental oxygen during daily life or during exercise training in pulmonary rehabilitation. The 6MWT is more sensitive for identifying exercise-induced desaturation than cycle testing [6]. Measurements of arterial oxygen saturation measured by pulse oximetry (S_{pO_2}) during the 6MWT are reliable [2], provided that an adequate pulse signal is obtained. Constant monitoring of S_{pO_2} during the 6MWT is needed to obtain an accurate measure of exercise-induced desaturation, as the lowest S_{pO_2} often does not occur at the end of the test [7, 8]. As a result, the Technical Standard recommends that S_{pO_2} is measured continuously during the 6MWT and the lowest value is recorded. Current data indicate that the 6MWT has an excellent safety profile when the test is stopped if S_{pO_2} falls to <80% [1]. Few data are available to define the safety profile if desaturation to less than 80% is permitted.

The 6MWD is highly sensitive to changes in methodology. Because the use of encouragement can increase the 6MWD, it is recommended that standardised phrases of encouragement are used. Provision of supplemental oxygen [9–12], the method for carrying the supplemental oxygen [13, 14] and the use of wheeled walkers [15–20] also have an important impact on 6MWD. These factors must be kept constant on repeat testing. The 6MWD should not be measured using a treadmill as this will result in substantially lower distances [21, 22]. Track layout and length may also affect performance on the test, with marked reductions in 6MWD when very short track lengths are used [23]; these factors should be kept constant where a comparison of 6MWD on subsequent occasions is required.

The 6MWD is responsive to changes observed with common treatments in COPD, interstitial lung disease and pulmonary arterial

hypertension [2]. Not surprisingly, it is more responsive to interventions that include exercise training, such as pulmonary rehabilitation, than to pharmaceutical interventions. A change in 6MWD of 30 m or more is considered to be clinically important [1].

There are many reference equations available for the 6MWD, allowing 6MWD to be reported as a percentage of the predicted walking distance. However, application of different reference equations gives rise to wide variation in the predicted distance [24]. This may be because of differences in the way that the tests were performed when the equations were generated, or differences between populations to whom the test was applied. Because of this variability, the Technical Standard suggests that a reference equation generated and verified in a local population should be applied when possible. A summary of reference equations can be found in the systematic review that accompanies the Technical Standard [2].

The incremental and endurance shuttle walking tests

The ISWT is an externally paced maximal exercise test where the speed of walking increases with each level, controlled by a series of pre-recorded signals. The test continues until the participant can no longer continue or cannot keep up with the required pace. The maximum duration of the test is 20 min. The ISWT is a valid measure of a cardiopulmonary exercise capacity in COPD and provokes a similar physiological response to a cardiopulmonary exercise test [2]. A lower ISWT predicts poor survival and increase risk of hospital re-admission in people with COPD [25–27]; however, there are few data on its use in patients with chronic respiratory disorders other than COPD. The ISWT is a reliable test, but there is evidence of a learning effect on the second test in the range of 20–25 m [2]. This is large enough to be clinically important when evaluating change over time. As a result, it is recommended that two ISWTs are performed and the best distance recorded [1].

The endurance shuttle walking test (ESWT) is a derivative of the ISWT, where patients walk for as long as possible at a predetermined percentage of maximum walking performance as assessed by the ISWT, frequently in the range

of 70–85% [28]. To set the speed for the ESWT, the ISWT must have been determined previously. One test is sufficient to obtain a reliable measure.

A small number of studies show that the ISWT is a significant predictor of survival and re-admission in people with COPD, with a lower distance predicting a greater risk of admission [25–27]. The relationship of ESWT to these outcomes is unknown.

Unlike the 6MWT, the track for the ISWT and the ESWT is fixed (fig. 1) and the instructions are given on the audio recording, which assists with standardisation. Use of supplemental oxygen and the way in which it is delivered will affect the measured distance. If patients are required to transport their own oxygen cylinder, oxygen supplementation may not improve the recorded distance [29]; but if it is transported by a clinician, the distance walked will increase [30]. As a result, if supplemental oxygen is to be used during testing, exactly the same mode of delivery should be used for repeat testing.

Both the ISWT and ESWT are responsive to changes with interventions in patients with COPD [2]. Like other endurance tests, the ESWT may be particularly useful for measuring changes following treatment. A change in ISWT of 47.5 m (five shuttles) or more is considered clinically meaningful. Thresholds for clinically meaningful change for ESWT have been reported as 65 s or 85 m after bronchodilator therapy [31].

Three papers have described reference values for the ISWT, two from South America [32, 33] and one from the UK [34]. There are no reference equations for the ESWT.

Preparing to conduct a field walking test

Some aspects of the testing procedure are common to all three field walking tests.

Equipment

The equipment required is commonly available in many clinics and is listed in table 1.

Location

Tests should be conducted along a quiet course or a corridor that has little traffic that could interrupt the test. Ensure the ambient

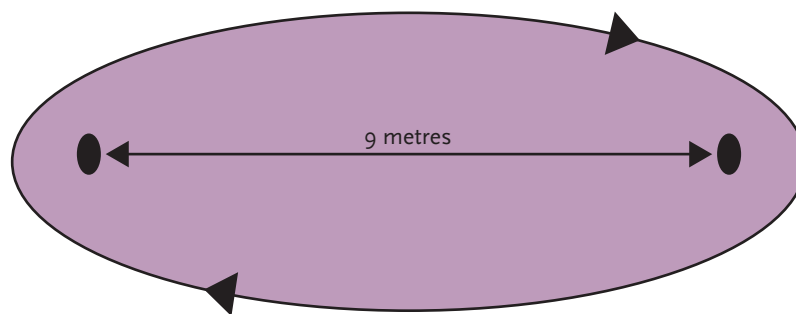


Figure 1

Course layout for the ISWT and ESWT. Cones are inset 0.5 m from either end to avoid abrupt changes in direction. Taken from the ERS/ATS Technical Standard [1].

temperature is comfortable for the patient to exercise. Testing should be performed in a location where a rapid response to an emergency is possible and the assessor should be certified in cardiopulmonary resuscitation with a minimum of Basic Life Support certification. The appropriate location of a crash cart should be determined by the physician supervising the facility. Supplies that must be available include oxygen, sublingual nitroglycerine and salbutamol (metered-dose inhaler or nebuliser). A telephone or other means of calling for help should be available in case of emergency. Physicians are not required to be present during all tests; however, the physician ordering or supervising the test may decide whether medical attendance at a specific test is required.

Patient assessment

Field walking tests have a good safety profile, with few adverse events reported in the literature [2]. However, in recent years, it has become clear that the 6MWT, ISWT and ESWT are strenuous tests for people with moderate to severe chronic lung disease, eliciting cardio-respiratory responses that are similar to those seen on a maximal, incremental exercise test [2]. Because of this, the Technical Standard recommends that the absolute and relative contraindications for exercise testing should be consistent with recommendations for maximal exercise testing [35] (table 2). Patients with any of these findings should be referred to the physician ordering or supervising the test for individual clinical assessment and a decision about whether the test should go ahead.

Patient preparation

Patients should wear comfortable clothing and appropriate shoes for walking. Patients should

use their usual walking aids during the test and this should be documented on the assessment form. Patients should not have exercised vigorously within 2 h of beginning the test but should have taken their usual medications. All subsequent testing occasions should occur at about the same time of day to minimise intra-day variability, including variability in self-paced tests (6MWT) associated with bronchodilator use [36]. If respiratory function tests are to be performed on the same day, this should occur prior to exercise testing, to avoid the confounding effects of exercise on these measures. The patients should then rest for at least 15 min before commencing an exercise test.

Table 1 Equipment required for conducting field walking tests

At least one chair, positioned at one end of the walking course
A validated scale to measure dyspnoea and subjective fatigue
Sphygmomanometer for blood pressure measurement
Pulse oximeter
Stopwatch
Pre-measured marks along the track/corridor
Access to oxygen and telephone in case of an emergency
An emergency plan
Portable supplemental oxygen if required to perform exercise test by patient
Clipboard with reporting sheet and pen
Taken from the ERS/ATS Technical Standard [1].

Table 2 Absolute and relative contraindications for field walking tests

Absolute	Relative
Acute myocardial infarction (3–5 days)	Left main coronary stenosis or its equivalent
Unstable angina	Moderate stenotic valvular heart disease
Uncontrolled arrhythmias causing symptoms or hemodynamic compromise	Severe untreated arterial hypertension at rest (200 mmHg systolic, 120 mmHg diastolic)
Syncope	Tachyarrhythmias or bradyarrhythmias
Active endocarditis	High-degree atrioventricular block
Acute myocarditis or pericarditis	Hypertrophic cardiomyopathy
Symptomatic severe aortic stenosis	Significant pulmonary hypertension
Uncontrolled heart failure	Advanced or complicated pregnancy
Acute pulmonary embolus or pulmonary infarction	Electrolyte abnormalities
Thrombosis of lower extremities	Orthopedic impairment that prevents walking
Suspected dissecting aneurysm	
Uncontrolled asthma	
Pulmonary oedema	
Room air SpO ₂ at rest ≤85%#	
Acute respiratory failure	
Acute noncardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (<i>i.e.</i> infection, renal failure, thyrotoxicosis)	
Mental impairment leading to inability to cooperate	

Adapted from the ATS/ACCP Statement on Cardiopulmonary Exercise Testing (2003) and taken from the ERS/ATS Technical Standard [1].#: exercise patient with supplemental oxygen.

Use of oxygen

If a patient is on long-term oxygen therapy, oxygen should be given at their standard flow rate or as directed by a physician or a protocol. For any test where the outcome is distance, oxygen flow rate should be held constant throughout the test. If the purpose of the exercise test is to compare distance walked between tests, any subsequent test should be performed using the same oxygen conditions, in order to make a valid comparison between testing occasions. If the flow rate must be increased for subsequent visits due to worsening gas exchange, this should be noted on the worksheet and considered during interpretation of any changes in performance.

The type of oxygen delivery device should also be noted on the report: for instance, the patient carried liquid oxygen or pushed or pulled an oxygen tank, the delivery was pulsed or continuous. Assessors should avoid transportation of the oxygen source where possible; however, if the subject is not able to transport their own oxygen cylinder, the assessor should try to walk slightly behind the patient to avoid setting the walking pace. It should be clearly documented

how the assessor has assisted with the transport of the oxygen, so any subsequent walk tests with the same subject can be performed in the same manner.

Measurements

Patients should rest in a chair, located near the starting position, before the test starts. Check for absolute and relative contraindications prior to test commencement (table 2). The following measurements should be obtained at rest:

- SpO₂ and heart rate from pulse oximetry
- Baseline dyspnoea and fatigue using a reproducible scale (*e.g.* Borg scale)
- Systemic blood pressure, if not recently documented

Immediately prior to the test

The assessor should provide standardised instructions, either verbally for the 6MWT (table 3) or from the ISWT or ESWT audio recording. Position the patient at the starting line. For the 6MWT, start the timer as soon as the patient starts to walk. The recorded instructions of the ISWT and ESWT will prompt the patient to start.

A pulse oximeter should be used for continuous measurement of SpO_2 and heart rate. The assessor should not “pace” the patient during the test, but should walk behind such that measures of nadir SpO_2 and end-test heart rate can be recorded without influencing the patient’s movement.

Immediately on test cessation

Record SpO_2 and heart rate from the oximeter; ask the patient to rate their dyspnoea and subjective fatigue on the standardised scale. It is important to understand the patient’s perception of limitations to their performance, so patients should be asked why they could not walk any further. It is common for patients to report either dyspnoea or leg fatigue as the primary factor limiting their performance on the test.

Reasons for the assessor to stop an exercise test

In some patients, profound desaturation ($SpO_2 < 80\%$) may occur during a field walking test. Use of a 6MWT protocol where the test is stopped if SpO_2 falls to $< 80\%$ is associated with an extremely low rate of adverse events [37]; this has not been reported for the ISWT or ESWT. Few data are available to determine the risk if the test is not stopped when SpO_2 falls to $< 80\%$. Stopping the test when SpO_2 falls to $< 80\%$ is also consistent with the recommen-

Table 3 Standardised instructions for the 6-min walk test

“The aim of this test is to walk as far as possible for six minutes. You will walk along this hallway between the markers, as many times as you can in six minutes.”

“I will let you know as each minute goes past and then at six minutes I will ask you to stop where you are. Six minutes is a long time to walk, so you will be exerting yourself. You are permitted to slow down, to stop, and to rest as necessary, but please resume walking as soon as you are able.”

“Remember that the objective is to walk AS FAR AS POSSIBLE for six minutes, but don’t run or jog.”

“Do you have any questions?”

Taken from the ERS/ATS Technical Standard [1].

dations for incremental exercise testing [35]. If SpO_2 recovers to $\geq 85\%$ during the 6MWT, the patient may be asked to recommence walking.

Other reasons for stopping the test include chest pain, intolerable dyspnoea, leg cramps, staggering, diaphoresis and a pale or ashen appearance. If a test is stopped for any of these reasons, the patient should sit or lie supine as appropriate. The following should be obtained based on the judgment of the assessor: blood pressure, pulse rate, SpO_2 , and a physician evaluation. Oxygen should be administered as appropriate.

Test repetition

To establish a stable baseline for the 6MWT and ISWT so that change over time can be detected, two tests must be completed. These can be performed on the same day but there must be interval between tests of at least 30 min and measures of heart rate and SpO_2 must have returned to baseline prior to the second test.

How to conduct a 6-min walk test

Course

The 6MWT should be performed along a flat, straight course with a hard surface with little pedestrian traffic. It is recommended that the walking course be ≥ 30 m in length, to be consistent with the courses on which reference equations have been generated [2]. The ends of the course should be marked so that they are easily visible to patients.

Conduct

Encourage the patient every 60 s using the standard phrases (table 4). Do not use other words of encouragement, or provide other non-verbal prompts. If the patient stops walking during the test, do not stop the timer. Allow the patient to rest in sitting or standing as they prefer. Whilst the patient is stopped, provide standardised encouragement every 30 s (table 4). Record the time that the patient stopped and the time that walking is recommenced.

Recording performance of the 6MWT

The primary outcome to be reported is 6MWD. Record the number of laps and any additional

distance covered (the number of metres or feet in the final partial lap). Calculate the total distance walked, rounding to the nearest metre or foot. If the patient stopped during the test, also report the total time stopped, the number of stops and the average walking speed over the 6 min [38]. In patients who cannot walk for 6 min this may provide alternative metrics for detecting change over time [38] and may assist with exercise prescription [39]. It is optional to report the 6MWD as a percentage of predicted. If the percent predicted 6MWD is reported, the reference equations used should be stated. Lowest SpO₂, end test heart rate and symptom scores obtained before and after the test should also be reported. A sample recording form can be found online at <http://erj.ersjournals.com/content/44/6/1428/suppl/DC2>.

How to conduct an ISWT

Course

The course is 10 m in length with two markers inset of 0.5 m from either end (fig. 1). The patient walks around the cones, thus avoiding abrupt changes in direction [40].

At the beginning of the test, the instructions are played to the patient from an audio recording (table 5). Once the instructions have been played, and the assessor has confirmed that the patient has understood, the patient is positioned at one end of the course. The speed at which the patient should walk is directed by an audio signal. There is a triple bleep indicating the test has started, at which point the patient commences walking and the timer is activated.

Conduct during the test

The assessor should watch the patient and also keep count of the number of shuttles as the subject completes them, throughout the duration of the test. It is advisable to time the performance as an additional measure to confirm manual recording of the number of shuttles completed. As the speed of walking increases every minute, indicated by a triple bleep [40], advise the patient “you now need to increase your speed of walking”. During the test only one verbal cue can be used to encourage the patient to pick up their speed: “you need to increase your speed to keep up with the test”.

Termination of the test

The test is terminated when either 1) the patient indicates that they are unable to continue, 2) if the operator determines that the patient is not fit to continue, or 3) the operator assesses that the patient was unable to sustain the speed and cover the distance to the cone prior to the beep sounding [40].

Operator termination of the test

The operator stops the test if the patient fails to reach the cone/marker in the time allowed [40]. This is defined as the patient being more than 0.5 m away from the cone when the bleep sounds on a second successive 10 m length. When the patient is just outside the 0.5 m marker they are advised to increase their speed of walking; if the patient fails to do so then the test is terminated and the distance recorded.

Table 4 Standardised encouragement for the 6-min walk test

1 min: “You are doing well. You have five minutes to go.”
2 min: “Keep up the good work. You have four minutes to go.”
3 min: “You are doing well. You are halfway.”
4 min: “Keep up the good work. You have only two minutes left.”
5 min: “You are doing well. You have only one minute to go.”
6 min: “Please stop where you are.”

If the patient stops during the test, provide the following encouragement every 30 s once SpO₂ is ≥85%: “Please resume walking whenever you feel able.”

Taken from the ERS/ATS Technical Standard [1].

Table 5 ISWT and ESWT instructions**Incremental shuttle walking test instructions**

The object of the progressive shuttle walking test is to walk as long as possible there and back along the 10 m course, keeping to the speed indicated by the bleeps on the audio recording. You will hear these bleeps at regular intervals.

You should walk at a steady pace aiming to turn around the cone at one end of the course when you hear the first bleep, and at the other end when you hear the next. At first your walking speed will be very slow, but you will need to speed up at the end of each minute. Your aim should be to follow the set rhythm for as long as you can. Each single bleep signals the end of a shuttle and each triple bleep signals an increase in walking speed. You should stop walking only when you become too breathless to maintain the required speed or can no longer keep up with the set pace.

The test is maximal and progressive. In other words, it is easier at the start and harder at the end. The walking speed for the first minute is very slow. You have 20 s to complete each 10 m shuttle, so don't go too fast. The test will start in 15 s, so get ready at the start now. Level one starts with a triple bleep after the 4 s countdown

Endurance shuttle walking test instructions

Walking test level (1–16) The instructions below are repeated for all 16 levels.

The walking speed for the first 2 min is fairly slow, so don't go too fast. The test will start in 10 s so get ready at the start now. The test starts with a triple bleep after a 4 s countdown.

At the next triple bleep increase your walking speed.

Taken from the ERS/ATS Technical Standard [1].

The test should be discontinued by the operator if S_{pO_2} falls to $<80\%$ as per the ATS statement on cardiopulmonary exercise testing [35].

Patient termination of the test

The patient may terminate the test if they are unable to continue. In respiratory disease, the common reason for terminating the test is due to excessive dyspnoea; however, other reasons may include fatigue (commonly leg fatigue) or pain (knee/hip/low back pain).

Recording performance of the test

Add up the number of lengths walked in metres (to the last 10 completed), and record on the form available online at <http://erj.ersjournals.com/content/44/6/1428/suppl/DC2>

How to conduct an ESWT*Course*

The test is conducted along the same course as described for the ISWT [40] (fig. 1).

Conduct of the test

Unlike the ISWT, the test is not incremental and is performed at a constant speed, but there is a warm up period of approximately 1.5 min [28]. At this point there are standardised instructions for the participant played from the audio recording advising the individual that at the next bleep the speed of walking will increase (table 5). This is the speed at which the test is performed. It is important to predefine the speed at which the test is going to be conducted. This is calculated from the ISWT; at a predefined percentage of peak performance on the ISWT (e.g. 70–85% estimated peak oxygen uptake) [41] or as a percentage of the peak speed achieved [42]. Once the instructions have been played to the patient, they are positioned at one end of the course and a triple bleep indicates the test has started [28]. The initial stages of the test are at a slower speed and are a “warm up” for the participant. After the warm up period the speed of walking increases, this is advised on the audio recording at the end of the warm up period. The timer is started from the end of the warm up period. Participants are then paced for the first two shuttles. During

the test only one verbal cue can be used to encourage the patient to pick up their speed “you need to increase your speed to keep up with the test”.

Termination of the ESWT

The procedure to terminate the test is as described for the ISWT [40].

Recording performance of the test

It is conventional for endurance performance to be recorded as time (in seconds). It is important that the speed of walking is recorded and time completed. A sample scoring sheet is included in the online supplement at <http://erj.ersjournals.com/content/44/6/1428/suppl/DC2>

Which field walking test should I choose?

Choice of a field walking test in clinical practice will be governed by the purpose of the test, the patient group and setting in which it is to be used, and the resources available.

Purpose of the test

Field walking tests may be performed to identify the patient’s exercise capacity (peak exercise capacity, functional exercise capacity or endurance), factors limiting exercise performance (dyspnoea, subjective fatigue, musculoskeletal limitations) and often their response to an intervention. The field tests can also be used to identify a threshold to predict survival and the likelihood of a hospital readmission, with a more extensive body of evidence reporting use of 6MWD rather than ISWT or ESWT for this purpose [2]. Prescription of exercise intensity for pulmonary rehabilitation may also be a consideration. The 6MWT and the ISWT/ESWT have been reported in all of these circumstances [2].

Patient group

The 6MWT has been well validated in a wide range of chronic respiratory conditions. To date our information about the ISWT and ESWT is almost solely derived from patients with COPD.

Self-evaluation questions

- Measurements taken at the beginning of a field walking test are:
 - Oxygen saturation and heart rate from pulse oximetry
 - Ratings of dyspnoea and fatigue
 - Systemic blood pressure, if not recently documented
 - All of the above
- Which of the following is NOT an absolute contraindication for field walking tests:
 - syncope
 - uncontrolled heart failure
 - uncontrolled asthma
 - hypertrophic cardiomyopathy
- Measures of oxygen saturation (SpO_2) that should be recorded during field walking tests include:
 - The highest SpO_2 recorded during the test
 - The lowest SpO_2 recorded during the test
 - The SpO_2 recorded each minute
 - No measures of SpO_2 are recorded
- The recommended track length for a 6MWT is:
 - ≥ 10 m
 - ≥ 20 m
 - ≥ 30 m
 - Dependent on the setting in which the test takes place
- The recommended number of tests to determine the 6MWD is:
 - One test
 - Two tests, with the best distance recorded
 - Two tests, with the average distance recorded
 - Three tests, with the best distance recorded
- A longer 6MWT will be obtained if:
 - Encouragement is given
 - A treadmill is used
 - A shorter track length is used
 - Standardised instructions are given
- A clinically important change in 6MWD has occurred if the distance walked increases by:
 - ≥ 25 m
 - ≥ 30 m
 - ≥ 40 m
 - ≥ 54 m
- The track for the shuttle walk tests is:
 - 10 m, with two markers inset 0.5 m from either end
 - 9 m, with two markers inset 0.5 m from either end
 - 10 m, with a marker at either end
 - 20 m, with a marker at either end
- On repeat testing, a clinically significant change in the ISWT is:
 - One shuttle
 - Two shuttles
 - Three shuttles
 - Five shuttles
- The main outcome of the ESWT is:
 - Distance in metres
 - Time in seconds
 - Time in minutes
 - None of the above

Setting

All three tests can be used effectively in an outpatient clinic setting. It is very difficult to perform a 6MWT in the patient's home as a track of sufficient length is rarely available [43]. The utility of all three tests in hospitalised patients, such as during or after an acute exacerbation of COPD, has not been well described.

Resources

Medical attendance is not required for routine field walking tests. The equipment required is minimal and available in most clinic settings (table 1) although the shuttle tests require a standardised recording (available from www.leicestershospitals.nhs.uk/aboutus/departments-services/pulmonary-rehabilitation/

for-health-professionals/incremental-shuttle-walk/). The space requirements of the tests differ substantially. The 6MWT should be conducted as recommended along a course at least 30 m in length; if this space is not available then consideration should be given to using the ISWT/ESWT. Both the 6MWT and ISWT require two tests to be performed prior to an intervention [2] and thus the time taken to conduct each test is comparable.

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Suggested answers

1. d.
2. d.
3. b.
4. c.
5. b.
6. a.
7. b.
8. a.
9. d.
10. b.