

Field Incremental Shuttle Walk Test: update from ERS/ATS recommendations and video-demonstration

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BOUNDLESS





Financial Interest Disclosure

(over the past 24 months)

Dina Brooks

I have no conflict to declare



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Objectives

- Understand how to administer the incremental shuttle walk test in accordance with best practice guidelines
- Describe the psychometric properties of the incremental shuttle walk test
- Understand the practical consideration when using this test



Incremental shuttle walk test

- Externally paced and analogous to an incremental exercise test
- **Maximal** and **progressive**
- Not supposed to pause- steady state at each level
- Test ends when the patient **too breathless** or can no longer keep up with the set pace
- The maximum duration of the test is 20 min.

Singh et al, 1992



Course layout



Incremental Shuttle Walk Test

Developed to overcome some of the difficulties associated with laboratory-based testing

Used mainly to:

- evaluate functional status
- monitor treatment effectiveness
- establish prognosis
- develop an individualized exercise program
- program evaluation
- **determine level of ESWT**





An official European Respiratory Society/ American Thoracic Society technical standard: field walking tests in chronic respiratory disease

Anne E. Holland, Martijn A. Spruit, Thierry Troosters, Milo A. Puhan, Véronique Pepin, Didier Saey, Meredith C. McCormack, Brian W. Carlin, Frank C. Sciurba, Fabio Pitta, Jack Wanger, Neil MacIntyre, David A. Kaminsky, Bruce H. Culver, Susan M. Revill, Nidia A. Hernandez, Vasileios Andrianopoulos, Carlos Augusto Camillo, Katy E. Mitchell, Annemarie L. Lee, Catherine J. Hill and Sally J. Singh

<http://www.thoracic.org/statements/resources/copd/FWT-Syst-Rev.pdf>



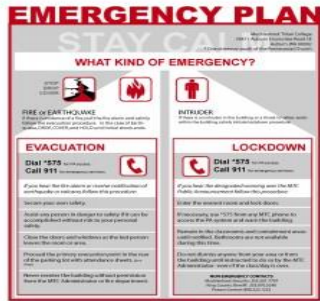
Equipment to consider for ISWT (1 of 2)

- At least one chair, positioned at one end of the walking course
- A validated scale to measure dyspnea and subjective fatigue
- Sphygmomanometer for blood pressure measurement
- Pulse oximeter
- Pre-measured marks along the track/corridor



Equipment to consider for ISWT (2 of 2)

- Access to oxygen and telephone in case of an emergency
- An emergency plan
- Portable supplemental oxygen
- Reporting Sheet
- Audio Tape of sounds



Contraindications for walk tests

Absolute

Acute myocardial infarction (3–5 days)
Unstable angina
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise
Syncope
Active endocarditis
Acute myocarditis or pericarditis
Symptomatic severe aortic stenosis
Uncontrolled heart failure
Acute pulmonary embolus or pulmonary infarction
Thrombosis of lower extremities
Suspected dissecting aneurysm
Uncontrolled asthma
Pulmonary oedema
Room air SpO_2 at rest $\leq 85\%^{\#}$
Acute respiratory failure
Acute noncardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (*i.e.* infection, renal failure, thyrotoxicosis)
Mental impairment leading to inability to cooperate

Relative

Left main coronary stenosis or its equivalent
Moderate stenotic valvular heart disease
Severe untreated arterial hypertension at rest (200 mmHg systolic, 120 mmHg diastolic)
Tachyarrhythmias or bradyarrhythmias
High-degree atrioventricular block
Hypertrophic cardiomyopathy
Significant pulmonary hypertension
Advanced or complicated pregnancy
Electrolyte abnormalities
Orthopaedic impairment that prevents walking



Instructions for ISWT (1)

The object of the progressive shuttle walking test is to walk as long as possible, **there and back** along the 10-metre course, **keeping to the speed indicated by the beeps on the audio recording**. You will hear these beeps 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 beep, 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 beep signals the end of a shuttle and each triple beep signals an increase in walking speed.**



Instructions for ISWT (2)

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.

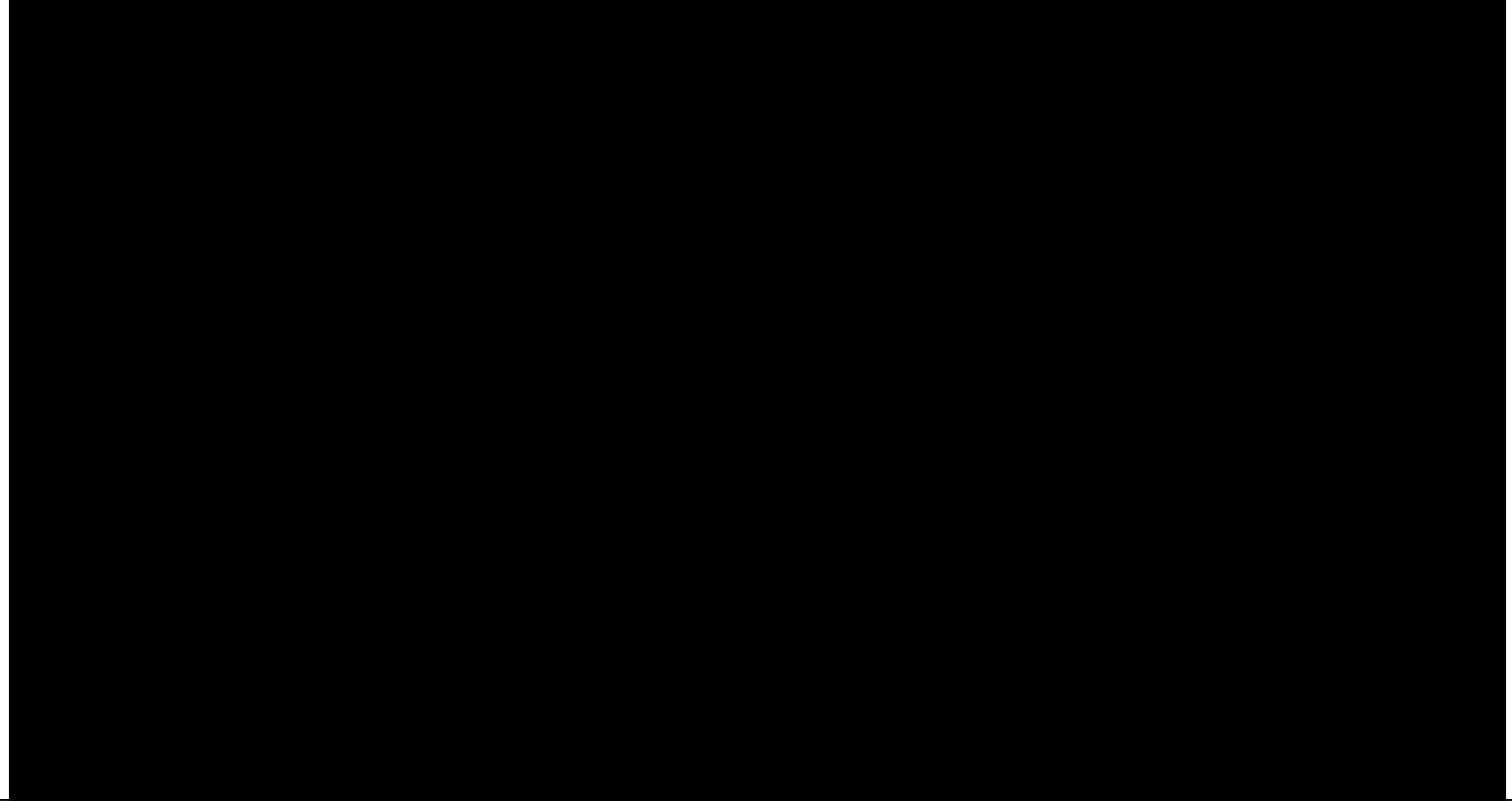
You have 20 seconds to complete each 10-metre shuttle, so don't go too fast. The test will start in 15 seconds, so get ready at the start now. Level one starts with a triple bleep after the 4-second countdown.



Voice Clip



Video Clip



Measurement properties (1 of 3)

- primary outcome is **distance**
- minimum is 0 m (if can't complete 10 m) and max is 1020 m.
- **good construct and predictive validity:**
 - strong relationships with measures of exercise performance and physical activity
 - associated with increased risk of hospitalization and mortality in people with chronic respiratory disease.



Measurement properties (2 of 3)

- The ISWT exhibit **good test–retest reliability** in COPD;
 - strong evidence of a learning effect for the ISWT
 - **2 tests** should be performed and best distance used
- The ISWT is **responsive** to rehabilitation
 - Standardized response means : 0.72-1.55
 - Fewer data on responsiveness to other interventions



Methodological properties (3 of 3)

- Interpretability in COPD
 - MID 47.5 m (95% CI 38.6 to 56.5 m) or approximately five shuttle
 - associated with feeling “slightly better”
 - a change of 78.7 m (approximately eight shuttles)
 - associated with feeling “better”
- Reference equations from South America and UK
 - age, sex and body mass index important variables
 - substantial variation in predicted values
 - use an equation generated and verified in a local population



Methodological Factors

- the **track** is fixed
- effect of encouragement minimal
- impact of **supplemental oxygen** is influenced by the mode of delivery, flow rate and device- ensure consistency
- impact of **walking aid** - ensure consistency



Safety



- elicit cardiopulmonary demands similar to cardiopulmonary exercise test
- no clear guidance on the value of monitoring SpO₂
- discontinued if SpO₂ falls below 80% but....
- no adverse events in cardiac disease
- not tested in patients with PAH.



Prescribing Exercise Intensity from ISWT (1 of 4)

- Distance used to determine the **walking speed**
- Speed set at **75% of the peak speed** (60% of their predicted peak VO_2)
- start with **10 minutes** of continuous walking, and build up to **30 minutes**.
- Can translate into lap counts

<http://www.pulmonaryrehab.com.au/>



Prescribing Exercise Intensity from ISWT (2 of 4)

Level	Speed		Distance	Predicted VO ₂ peak	Time / shuttle	Number of shuttles	
	m/s	km/h				m	ml/kg/min*
1	0.50	1.80	0-30	4.4-4.9	20.00	3	3
2	0.67	2.41	40-70	5.2-5.9	15.00	4	7
3	.084	3.03	80-120	6.2-7.2	12.00	5	12
4	1.01	3.63	130-180	7.4-8.7	10.00	6	18
5	1.18	4.25	190-250	8.9-10.4	8.57	7	25
6	1.35	4.86	260-330	10.7-12.4	7.50	8	33
7	1.52	5.47	340-420	12.7-14.7	6.67	9	42
8	1.69	6.08	430-520	14.9-17.2	6.00	10	52
9	1.86	6.69	530-630	17.4-19.9	5.46	11	63
10	2.03	7.31	640-750	20.22-22.9	5.00	12	75
11	2.20	7.92	760-880	23.2-26.2	4.62	13	88
12	2.37	8.53	890-1020	26.4-30.2	4.29	14	102

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Prescribing Exercise Intensity from ISWT

If Distance walked is 200 m:

- Peak walking speed → 4.25 kph (Level 5)
- Training walking speed → 75% of 4.25 kph = 3.2 kph

- For 1 hour walk → 3.2 km
- For 30 minute walk → 1.6 km
- For 20 minute walk → 1 km
- For 10 minute walk → 0.5 km

<http://www.pulmonaryrehab.com.au/>



When to use ISWT

- High level patients (ISWT over 6MWT)
- Ambulatory O₂
- Use of ambulatory aids
- Musculo-skeletal problems
- Availability of reference equations
- Hearing ability



Thank you

