i̲Walk

A **GUIDE** to an Evidence-Informed Approach to Using the **10-METRE** and **6-MINUTE** WALK TESTS POST-STROKE

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Canadian Version

First Edition

UNIVERSITY OF **TORONTO**

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ontario stroke network
Advancing the Ontario Stroke System

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Acronyms

ADL	Activities of Daily Living
AFO	Ankle Foot Orthosis
ATS	American Thoracic Society
BBS	Berg Balance Scale
BP	Blood Pressure
CMSA	Chedoke-McMaster Stroke Assessment
ERS-ATS	European Respiratory Society-American Thoracic Society
5mWT	5-metre Walk Test
FIM	Functional Independence Measure
HR	Heart Rate
ICC	Intraclass Correlation Coefficient
LTG	Long-term goal
MCID	Minimal Clinically Important Difference
MDC	Minimal Detectable Change
MDC_{90}	Minimal Detectable Change at the 90% confidence level
RPE	Rating of Perceived Exertion
SD	Standard Deviation
SEM	Standard Error of Measurement
SMART	Specific, Measureable, Achievable, Realistic, Time-bound
STG	Short-term goal
6MWT	6-Minute Walk Test
10mWT	10-metre Walk Test
2MWT	2-Minute Walk Test
VO_{2peak}	Peak Oxygen Consumption
VO_2	Oxygen Consumption

Glossary

Construct Validity	The degree to which the scores of an instrument are consistent with hypotheses (for instance with regard to internal relationships, relationships to scores of other instruments, or differences between relevant groups) based on the assumption that the instrument validity measures the construct to be measured.[1]
Intraclass Correlation Coefficient (ICC)	A statistic used to estimate reliability. The ICC represents the proportion of variability in scores on a measure that is due to true variability in scores.[2] ICC values are interpreted as: ICC≥0.75 (excellent), ICC>0.40 to <0.74 (acceptable), ICC≤0.40 (poor).[3] An ICC value >0.90 is sufficient for making clinical decisions based on the individual's test performance.[4]
Intra-rater Reliability	Variation in scores on a measure obtained by the same observer as a result of multiple exposures to the same stimulus.[2]
Inter-rater Reliability	Variation in scores on a measure between two or more observers exposed to the same stimulus.[2]
Length of a walkway	The measurement of a walkway from end to end.
Minimal Clinically Important Difference (MCID)	The smallest change in score on a measure that would be considered beneficial.[2]
Minimal Detectable Change (MDC)	A statistic that accounts for the reliability of a measure and is used to estimate measurement error. The MDC represents the magnitude of change that must occur on a measure for the change to exceed measurement error and be considered as "true change" in ability.[5]
Minimal Detectable Change at the 90% confidence level (MDC$_{90}$)	The MDC at the 90% confidence level (MDC$_{90}$) means that 90% of truly unchanged patients will display random fluctuations in performance equal to or less than the MDC value.[5]
Minimal Detectable Change at the 95% confidence level (MDC$_{95}$)	The MDC at the 95% confidence level (MDC$_{95}$) means that 95% of truly unchanged patients will display random fluctuations in performance equal to or less than the MDC value.[5]
Normative value	Performance values on a measure that individuals who are healthy and able-bodied would achieve.
Pearson Correlation Coefficient	A statistic represented by "r" that reflects the strength of a linear relationship between two variables.[6] Pearson r values are interpreted as: r ≥0.75 (strong), r=0.50 to 0.69 (moderate), r=0.30 to 0.49 (weak), and r<0.30 (weak).[1]
Test-retest Reliability	The degree to which an instrument yields stable scores over time among respondents who are assumed not to have changed on the domains being assessed.[2]

Module 1: Introduction

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By the end of this module you will be able to:

✓ **Describe the rationale, purpose, users, development, components, and organization of the iWalk Toolkit and how to approach learning the information in the iWalk guide.**

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Why is the iWalk Toolkit Needed?

The *Canadian Stroke Best Practice Recommendations*[7] state that standardized, valid assessment tools should be used to evaluate functional activity limitations such as walking. Fewer than 50% of physical therapists, however, report using standardized measures of walking during initial assessment or to monitor change in walking of people post-stroke.[8] Also, 40% of physical therapists are unaware of available measures of walking ability post-stroke and 80% desire recommendations on which measures to use.[8] The 10-metre walk test (10mWT) and 6-minute walk test (6MWT) are highly recommended to evaluate walking across care settings and levels of acuity post-stroke based on psychometric evidence and clinical utility.[9] A clinical toolkit that facilitates use of the 10mWT and the 6MWT post-stroke and incorporates the extensive available research evidence supporting these tests, however, is not available.

What is the Purpose of the iWalk Toolkit?

The iWalk toolkit is designed to help physical therapists and other health providers to:

- Administer the 10mWT and the 6MWT with people post-stroke;
- Interpret test performance using available research evidence;
- Educate patients about test performance and set goals for each test; and
- Select treatments with potential to improve walking speed and distance.

What are the Components of the iWalk Toolkit?

The iWalk toolkit has three components:

1. iWalk Guide
2. iWalk Videos
3. iWalkAssess App

Who Should Use the iWalk Toolkit?

The iWalk toolkit is designed for use by **physical therapists** that provide clinical services to improve the walking ability of people post-stroke in acute care, rehabilitation, and outpatient settings. Other health professionals, educators, students, and researchers interested in stroke rehabilitation may also find the toolkit useful. The tests described in the toolkit are applicable to people with a variety of health conditions in addition to stroke, such as:

- Parkinson's disease
- Multiple sclerosis
- Post-fracture complications
- Chronic obstructive pulmonary disease
- Congestive heart failure

How was the iWalk Toolkit Developed?

A knowledge translation framework[10] and results from qualitative research[11-13] and systematic reviews[14-16] guided development of the iWalk toolkit.[17] Educational theory[18] and a guideline development framework[19,20] were used to design features and activities to optimize learning and clinical application. Authors include physical therapy clinicians and educators, provincial stroke network leads, as well as researchers from physical therapy, medicine and engineering. Validation of the iWalk guide involved an external review by 28 individuals, including 10 content experts from Canada, the United States, Australia and Sweden, and 18 Canadian physical therapists from acute care, inpatient rehabilitation, and outpatient settings (i.e., end-users of the guide).

What are the iWalk Videos?

Three iWalk videos are available on YouTube™. The first video includes educational content and shows a physical therapist administering the 10mWT and 6MWT with a person post-stroke. The other two videos are demonstration videos that show the 10mWT and 6MWT being administered without interruption, from start to finish. The videos can be viewed at:

https://www.youtube.com/channel/UCh65ZgnzmSuJ2jWDjTVz1-w/videos

What is the iWalkAssess Application (or "App")?

iWalkAssess is an app that has test protocols, timing tools, a 6MWT length counter, and algorithms for comparing test performance to reference values to make it easy for physical therapists to administer walk tests and interpret performance. iWalkAssess is available for use on iPhones and Android phones. The app can be downloaded from the App Store and Google Play.

How is the iWalk Guide Organized?

This **Introduction module** highlights the top 10 reasons to use the 10mWT and 6MWT. It also lists three iWalk recommendations for the clinical use of the 10mWT and the 6MWT and the Canadian Stroke Best Practice Recommendations that the iWalk guide is designed to support. Subsequently, there are four education modules entitled: **Module 2: Performing the Tests; Module 3: Interpreting Test Performance; Module 4: Educating and Setting Goals;** and **Module 5: Selecting Treatments** to improve walking distance and speed. **Module 6** describes an audit and feedback approach for evaluating practice. **Module 7** outlines learning activities to help integrate the information in the guide. Individual documents that are available for download on the iWalk webpage have been highlighted as *Online Resources* throughout the iWalk guide. Resources include agendas for small group learning sessions, an equipment and space requirements checklist, test protocols, test instructions to use with people with aphasia, data collection and goal setting forms, and a quick look-up guide of reference values to facilitate application to practice. These resources are freely available online.

How Should You Learn Information in the iWalk Guide?

1. Form a working group of at least two health professionals who are responsible for evaluating walking in your clinical setting or complete the specified activities on your own.
2. Complete the iWalk Equipment and Space Requirements Checklist (*refer to Online Resources: 1. Equipment & Space Requirements Checklist*)**.**
3. Schedule three one-hour working group sessions with ~2 weeks between sessions. Make the time interval between sessions longer if you don't have many people post-stroke on your caseload.
4. Follow the agendas for Sessions 1-3 (*refer to Online Resources: 2. Learning Sessions-Instructions & Agendas*)**.** Sessions focus on practicing the tests, interpreting test performance, and educating and setting goals.

What will it Cost to Implement the 10-metre and 6-Minute Walk Tests?

Refer to *Online Resources: 3. Equipment & Training Costs to Implement the 10mWT & 6MWT* for a description of the equipment and training costs to implement the 10mWT and 6MWT.

How can Walk Test Performance be added to Electronic/Paper Health Records?

Refer to *Online Resources: 6.10mWT (Comfortable Pace) Data Collection & Goal Setting Form and 10. 6MWT Data Collection & Goal Setting Form* for forms that can be inserted or adapted for use in electronic or paper-based health records.

Top 10 Reasons to Use the 10-metre and 6-Minute Walk Tests

1. **The 10-metre walk test (10mWT) and 6-minute walk test (6MWT) are recommended for use post-stroke** by the *Canadian Stroke Best Practice Recommendations*,[7,21] the Dutch clinical practice guideline for physiotherapy post-stroke,[22] and the American Physical Therapy Association Neurology Section StrokEDGE Task Force.[9]

2. **The 10mWT and 6MWT are highly reliable in people post-stroke.** Intraclass correlation coefficient (ICC) values for test-retest or inter-rater reliability of the 10mWT range from 0.89 to 0.96;[23-25] ICC values for test-retest reliability of the 6MWT range from 0.96 to 0.99.[24,26-30]

3. **Higher walking speeds correlate with more 'normal' muscle activations and movement patterns of the lower extremities during walking.**[31]

4. **10mWT and/or 6MWT performance relates to the ability to perform activities of daily living**[32,33] **(ADLs) and physical activity.**[34-39]

5. **Normative values,**[15] **and estimates of minimal detectable change**[24] **(MDC) and minimal clinically important difference**[40] **(MCID) are available** to help interpret test performance.

6. **People post-stroke identify improvement in walking as a rehabilitation goal.**[41] Measuring outcomes that patients value and prioritize is part of an evidence-based client-centred approach to stroke care.[42]

7. **Treatments that improve walking distance and speed are available.** Task-oriented walking training, treadmill training, and aerobic training, which are recommended treatments in Canada,[7] improve mean 10mWT and 6MWT performance post-stroke.[43-46]

8. **10mWT and 6MWT performance provide an indication of ability to walk in the community, which is a priority post-stroke.**[47] Walk test performances can be compared to crosswalk speeds and distances required to do shopping and other activities.[14]

9. **The 10mWT and 6MWT are simple, inexpensive and easy tests to learn, and require minimal equipment.**

10. **Walking distance and speed are "global health indicators" that predict mortality in older adults.** As walking speed decreases after the age of 65, so does the probability of survival.[48] Community-dwelling older adults performing in the bottom 25% for time to walk 400 metres show a three-fold higher risk of death than those in the top 25%.[49]

iWalk and Related Canadian Stroke Best Practice Recommendations

The iWalk research team developed the following recommendations to guide the clinical use of the 10-metre and 6-minute walk tests.

iWalk Recommendations

1. *Administer* the **10-metre walk test** and the **6-minute walk test**, as part of a comprehensive stroke initial assessment, to every person post-stroke who:

   – Can walk independently or with assistance from not more than one person, with or without mobility aids and orthoses;
   – Can follow multi-step instructions required to complete each test; and
   – Identifies improvement in walking as a rehabilitation goal.

2. *Educate* the patient, family, caregiver, and healthcare team and set *client-centred goals* for walking speed and distance with the use of normative values, community ambulation requirements and estimates of minimal detectable change (MDC), combined with clinical judgement and patient preferences.

3. *Re-administer* the 10-metre walk test and the 6-minute walk test:

   – When a change in walking ability occurs (e.g., change in mobility aid);
   – When a response to a treatment regimen is expected; and
   – At the time of discharge.

The iWalk toolkit is designed to support the *Canadian Stroke Best Practice Recommendations* below. Recommendations and levels of evidence are updated regularly and can be found at: http://www.strokebestpractices.ca.

Related Canadian Stroke Best Practice Recommendations[7]

1. Assessments of impairment, functional activity limitations, role participation restrictions and environmental factors should be conducted using standardized, valid assessment tools; tools should be adapted for use with patients who have communication differences or limitations where required [Evidence Level B].

2. Patient, family and caregiver education is provided both formally and informally, with consideration given to individual and group settings as appropriate [Evidence Level A].

3. Patients and families should be involved in their management, goal setting, and transition planning [Evidence Level A].

Module 2: Performing the Tests

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By the end of this module you will be able to:

- ✓ **Describe what the 10-metre and 6-minute walk tests are used to evaluate**
- ✓ **Explain why the 10-metre and 6-minute walk test protocols are recommended**
- ✓ **Determine which patients are appropriate for the 10-metre and 6-minute and walk tests**
- ✓ **Describe how to administer the 10-metre and 6-minute walk tests and document results**

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Order of Conducting the 10-metre and 6-Minute Walk Tests in the Same Session

To minimize the effect of fatigue on test performance when the 10-metre walk test (10mWT) and the 6-minute walk test (6MWT) are being administered in the same evaluation session, it is advisable to conduct the 10mWT first, allow the patient to perform activities while sitting until he/she feels adequately rested, and then conduct the 6MWT.

Performing the 10-metre Walk Test at a Comfortable Pace

Overview

The 10mWT requires a patient to walk at a comfortable pace over the middle 10-metre portion of a 14-metre walkway. Patients should use their presently used walking aids and walk independently if possible. If necessary, physical assistance from one person is allowed. No practice trial is required. Refer to *Online Resources: 4. 10-metre Walk Test (Comfortable Pace) Protocol* for a printer-friendly version of the walk test protocol.

What does this Test Measure?

Comfortable walking speed. Walking speed is a component of walking capacity. *Capacity* refers to the ability of a person to perform an activity in a controlled environment such as in a hospital.[50]

What Performance is Documented?

The following are documented in the health record:

- Test conducted.
- Walking speed in metres per second (m/s) to two decimal places (this is the primary outcome reported)
- Physical assistance provided, walking aid and orthosis used, shoes worn
- Walking speed as a percentage of the norm, the norm, and the norm publication source
- Short- and long-term goals (STG, LTG) for test performance

Why was the 10-metre Walk Test Chosen instead of the 5-metre Walk Test for Use Post-Stroke?

- In several studies, 10mWT performance has improved, on average, following task-oriented walking training,[43] treadmill training,[44] and aerobic training.[45] These treatments are recommended in the *Canadian Stroke Best Practice Recommendations*.[7]
- 10 metres better correlates than 5 metres with distances required to cross the street.
- The 10mWT, not the 5-metre walk test, is recommended for use post-stroke.[9,22]

Why did we Choose the Protocol in this Module?

Use of the proposed 10mWT protocol is feasible[51] and reliable[25] in patients post-stroke.

What is the Inter-rater Reliability of the 10-metre Walk Test Protocol with No Practice Trial Post-Stroke?

ICC = 0.96 (p≤0.001)[25]

Note: ICC values ≥0.75 are considered as excellent.[3] An ICC value >0.90 is sufficient for making clinical decisions based on the individual's test performance.[4]

10-metre Walk Test (Comfortable Pace) Protocol

1. 10-metre Walk Test Screening

Which patients are appropriate for this test?

Patients who:

1. Can walk 14 metres independently or with assistance from not more than one person. Physical assistance may include providing manual support at the waist, but not advancing the lower limb or supporting the lower limb in stance phase to avoid knee buckling. Mobility devices (e.g., cane, walker) or braces (e.g., ankle foot orthosis (AFO)) may be used.
2. Can follow the one-step instruction required to complete the test. Supportive communication strategies for people with aphasia and translators may be used as needed.

2. Marking the 14-metre Walkway for the 10-metre Walk Test

Location:
Choose an uncluttered hallway, preferably a quiet location, to mark the walkway.

You will need:
☐ A measuring tape or metric measuring wheel to measure distances.
☐ Tape (electrical tape works well) and scissors to mark the floor.

Procedure:
1. Identify the start end of the walkway. Leave space behind the starting point where a patient can be seated, preferably not in front of a door.
2. Extend the measuring tape along the wall. If you're alone, you can tape the measuring tape to the floor to keep it extended and straight.
3. Use a 50-centimetre long strip of tape to mark the start point, 2-metre acceleration distance, 10-metre test distance, and the final 2-metre deceleration distance. Ideally, the tape should be permanently left on the floor.

To follow along using iWalkAssess, go to the main menu and select "10-metre Walk Test" and then "View Protocol"
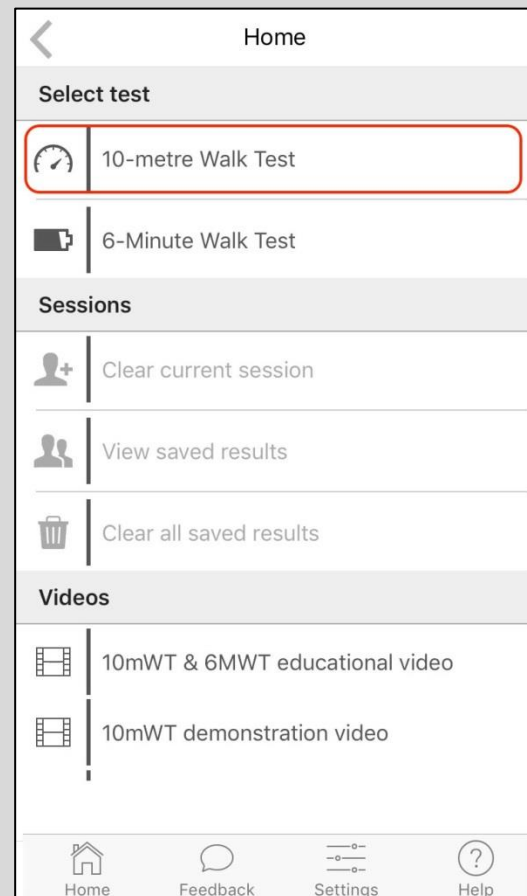
4. Optional: With appropriate permission, work with the custodial staff to have them wax over the tape to create a semi-permanent walkway for the walk test.

> **?** **DID YOU KNOW** older adults need some distance to reach a constant walking speed? In one study, non-disabled older adults (average age: 82 years, n=34) required 1.07 metres, on average, compared to 0.6 metres in younger adults (average age: 23 years, n=43), to reach a constant walking speed.[52]

3. 10-metre Walk Test Equipment

iWalkAssess has a timer that eliminates the need for a stopwatch.

- ☐ 10mWT Protocol and Data Collection and Goal Setting Form on clipboard
- ☐ Measured and marked walkway
- ☐ 2 armchairs (depending on patient's functional level)
- ☐ 1 pylon to mark the end of the walkway
- ☐ Stopwatch
- ☐ Transfer belt (if needed)

4. Conducting the 10-metre Walk Test

Pylons:
Place a pylon that is easily visible to patients at the end of the walkway.

Chairs:
Place an armchair or wheelchair at the start end of the walkway so the patient can sit while you explain the test. If necessary, place a second chair at the end of the walkway for patients who may need to sit after completing the test.

Figure 1. 10-metre walk test set-up

Start timing   Stop timing
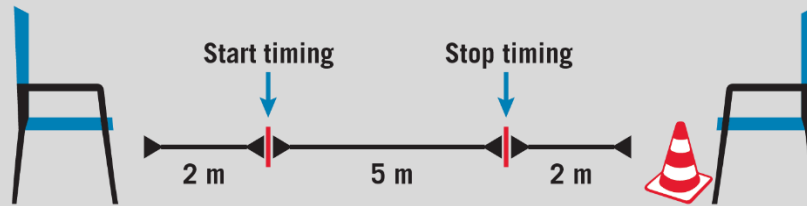
2 m   5 m   2 m
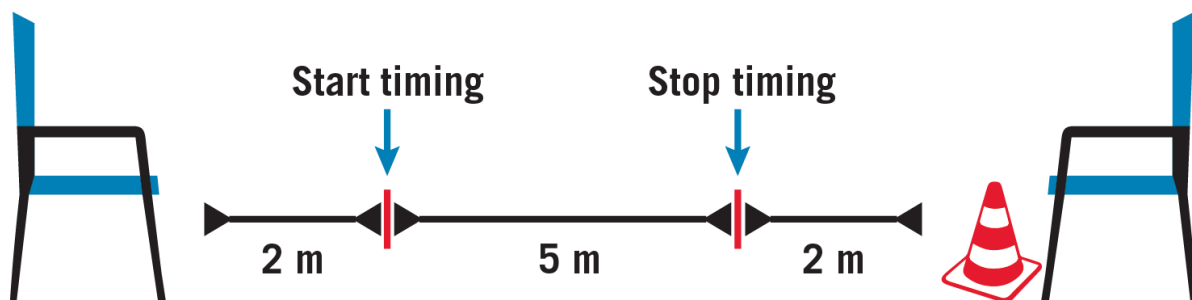
TIP: If your setting (e.g., a patient's home) does not have a 14-metre walkway, the 5-metre walk test (5mWT) can be used as it only requires a 9-metre walkway. The reliability of the 5mWT post-stroke is excellent (ICC=0.86[53] and 1.00[54]). Do not use a 5-metre walk and return as this tests a different activity.

5-metre walk test set-up:

Number of times to perform test:
Once[25] (do not conduct a practice trial).

Clothing, footwear, and eyewear:
The evaluator should ensure that the patient wears comfortable clothing, and the **same** supportive footwear, and corrective eyewear (if applicable) on test and retest.

Walking aids and orthoses:
Patients should use their presently used walking aids and orthoses during the test (cane, walker, ankle foot orthosis (AFO), etc.) and this must be documented in order to compare performance. Do not allow the patient to hold a handrail in the corridor if one is available. Use a transfer belt if appropriate.
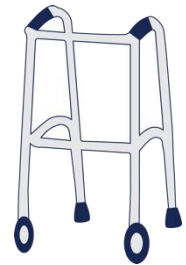
CLINICAL NOTE: If the patient has recently progressed to a less supportive ambulatory aid, the patient should perform the test with the ambulatory aid that he/she is most comfortable with so that test performances will be comparable.

Position of the evaluator:
Patients determine their own walking pace. The evaluator should walk on the patient's affected side and slightly behind the patient so as not to pace the patient. Close supervision is required to prevent loss of balance.

Physical assistance during the test:
Patients should walk independently if possible. If necessary, physical assistance from one person (e.g., for balance, or weight-shifting) is allowed. The level of assistance required should be evaluated in a standardized way. We have adapted the rating scale used for the Activity Inventory of the Chedoke-McMaster Stroke Assessment[55] (CMSA) for this purpose (see below).

Evaluator walks on the patient's affected side and slightly behind the patient to avoid pacing.

Scale for Rating Level of Human Assistance Required to Walk (adapted from CMSA[55])

Level	Description of Human Assistance Required to Walk
INDEPENDENT - Another person is not required for the activity (NO HELPER).	
7	**Complete Independence -** All of the tasks which make up the activity are typically performed safely, without modification, assistive devices, or aids, and within a reasonable amount of time.
6	**Modified Independence -** One or more of the following may be true: an assistive device (e.g., foot orthoses, cane) is required to complete the task; the activity takes more than reasonable time (at least 3 times longer than normal); or there are safety (risk) considerations.
DEPENDENT - Another person is required for either supervision or physical assistance in order for the activity to be performed, or it is not performed (REQUIRES HELPER).	
Modified Dependence - The client expends half (50%) or more of the effort. The levels of assistance required are:	
5	**Supervision -** The client requires no more help than standby supervision, cueing or coaxing, without physical contact.
4	**Minimal Contact Assistance -** The client requires no more help than touching, and client expends 75% or more of the effort.
3	**Moderate Assistance -** The client requires more help than touching, or expends half (50%) or more (up to 75%) of the effort.
Complete Dependence - The client expends less than half (less than 50%) of the effort. Maximal or total assistance is required, or the activity is not performed. The levels of assistance required are:	
2	**Maximal Assistance -** The client expends less than 50% of the effort, but at least 25%.
1	**Total Assistance -** The client expends less than 25% of the effort, 2 persons are required for assistance, or the task is not tested for safety reasons.

With iWalkAssess, you can play an audiorecording of the test instructions.

Encouragement:
During testing, do not provide verbal encouragement to the patient.

Patient Instructions:
The patient begins seated at the start end of the walkway. The evaluator says:

"I am going to measure your comfortable walking speed. I will say "Ready, set, go". When I say "go", walk in a straight line at a pace that is safe and comfortable for you, until you reach the pylon. Now I'm going to show you. Do you have any questions?"

Ask the patient to stand behind the start line. Say *"Ready, set, go".*

On the word 'go', the patient begins to walk. The evaluator starts timing when the patient's first foot fully crosses the line at the 2-metre mark at the end of the acceleration zone. The evaluator stops timing when the patient's first foot fully crosses the line at the 12-metre mark at the beginning of the deceleration zone. The patient continues to walk the final 2-metre deceleration distance to the pylon.

iWalkAssess calculates walking speed for you.

Document the time taken to walk 10 metres on the data collection form or in the iWalkAssess app. *Refer to Online Resources: 6. 10mWT (Comfortable Pace) Data Collection & Goal Setting Form.*

Calculate walking speed as follows:

10mWT walking speed (m/s) = 10 metres / Time in seconds taken to walk 10 metres

In the patient's health record, document walk test performed (and pace instructed), walking speed performance, test details (i.e., assistance level, walking aid and orthosis used, shoes worn) for comparison at re-test, % of norm, norm value and source, and short- and long-term goal (STG, LTG) using the following format:

10mWT (comfortable) = X.XX m/s (assistance level, aid used, orthosis used, shoes worn), % of norm (norm, source), STG, LTG

EXAMPLE: DOCUMENTING 10mWT PERFORMANCE IN THE PATIENT'S HEALTH RECORD

10mWT (comfortable) = 0.58 m/s (assistance=Level 5, quad cane, (L) AFO, running shoes), 51% of norm (norm=1.13 m/s, Bohannon 2011), STG (2 weeks) = 0.75 m/s to avoid incontinence, LTG (6 weeks) = 1.20 m/s to cross street on time.

Normative values and goal setting are presented in *Modules 3* and *4*, respectively

10-metre Walk Test (Comfortable Pace) Instructions for People with Aphasia

The following slides and instructions can be used to instruct people with aphasia on how to perform the 10mWT. We recommend that you print the full-page slides and instructions (*refer to Online Resources: 5. 10mWT (Comfortable Pace) Instructions for People with Aphasia*), place each page in a plastic cover and keep them held together with a ring for use with patients. Store the slides in a designated location.

Figure 2. Slides and instructions for administering the 10mWT to people with aphasia

Show slide 1, say: *"Walk here to here"* as you point from the start mark the pylon.

Show slide 2, say: *"Walk at a comfortable speed"*.

Show slide 3 and say, *"Questions?"*

Show slide 4 and say: *"Ready? Go!"* Patient performs the test
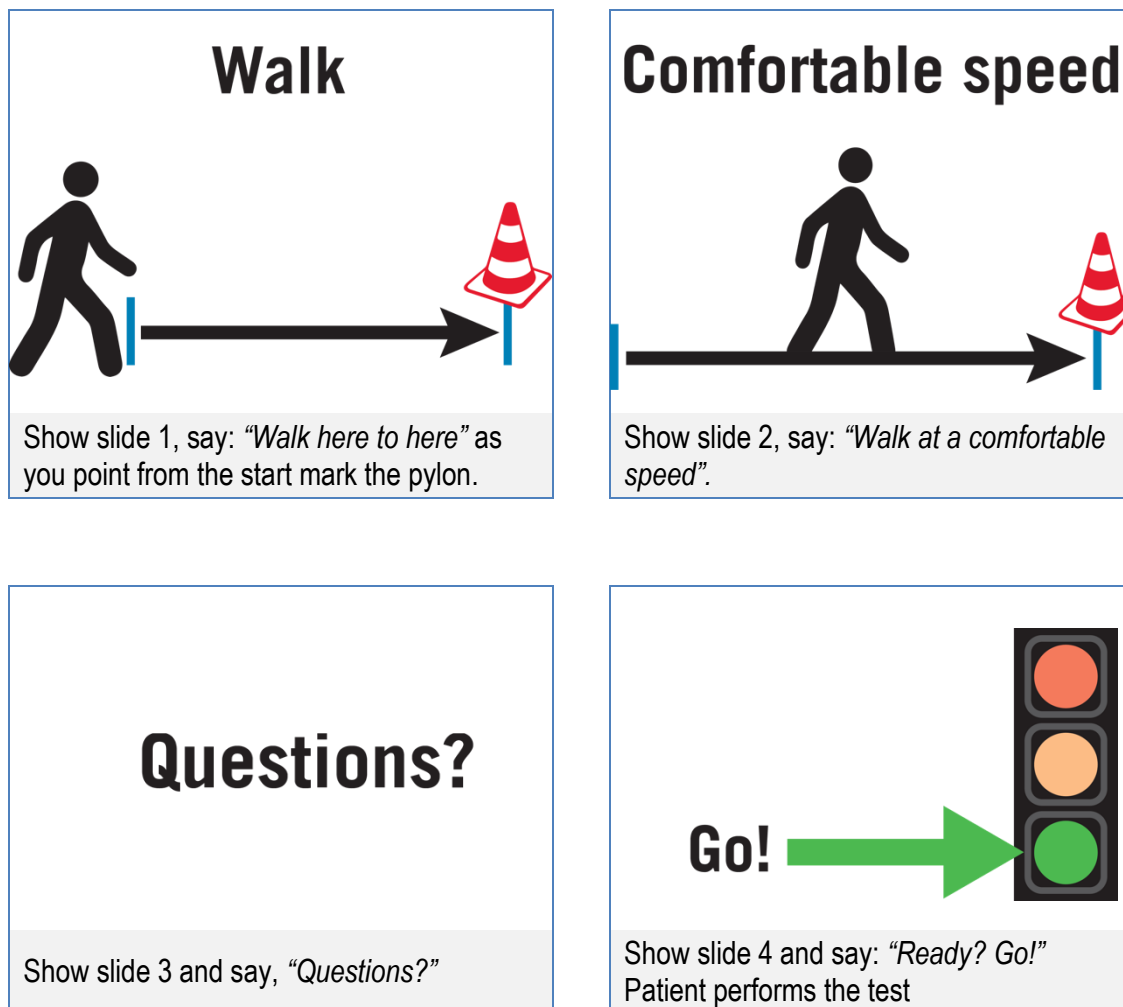
Performing the 6-Minute Walk Test

Overview

The 6MWT requires patients to walk back and forth along a walkway to cover the maximum distance possible in 6 minutes. Patients should use their presently used walking aids and walk independently if possible. The patient does not need to be able to walk continuously for 6 minutes to perform the test. The test can be introduced to the patient as a baseline for comparing future performance. If necessary, physical assistance from one person is allowed. No practice trial is required. Refer to *Online Resources: 7. 6-Minute Walk Test Protocol* for a printer-friendly version of the walk test protocol.

Why is a Standardized 6-Minute Walk Test Protocol Needed Post-Stroke?

The same protocol must be used across the care continuum post-stroke so that the scores will be comparable. Longer walkway lengths[56] and use of encouragement[57] increases the distance walked so both have to be standardized. Using a measuring wheel during the test to evaluate the distance walked will result in an increased distance than using a walkway with each metre marked because the measuring wheel tracks the distance walked during turns. While this may be attractive, the measuring wheel cannot be used when patients need standby guarding or physical assistance to walk. A marked walkway is preferred as it can be used for people who need and do not need physical assistance to walk and will ensure that 6MWT test performances are comparable as the patient's walking ability improves.

What can the 6-Minute Walk Test be Used to Measure Post-Stroke?

1. **Functional walking capacity.**
Functional walking capacity refers to the ability of an individual to maintain a moderate level of walking activity over a time period that may be required for activities of daily living (ADLs).[35] 6MWT performance predicts physical function (e.g., bathing, bending, walking, stairs, carrying groceries, vacuuming, running) in community-living people post-stroke.[58]

2. **Motor control impairments during walking.**
The distance walked in 6 minutes reflects the level of balance, strength and coordination of the person post-stroke. Lower extremity motor function and balance performance during functional tasks in sitting and standing are significantly correlated with 6MWT distance.[59]

3. **Response to sub-maximal exercise.**
Heart rate (HR), blood pressure (BP), and a rating of perceived exertion (RPE) measured before and after the 6MWT, and observations of the patient during the 6MWT, can be used to evaluate the patient's cardiovascular response to submaximal walking.[35]

DID YOU KNOW there is some evidence that the 6MWT is an indicator of aerobic capacity post-stroke? People post-stroke have been observed to reach a level of exercise intensity during the 6MWT (i.e., oxygen consumption (VO$_{2peak}$))[60] considered sufficient for aerobic training.[61] Weak to strong correlations between 6MWT distance and VO$_{2peak}$ observed during a progressive exercise test, ranging from 0.40 to 0.73,[60,62-65] have been reported. In some studies, however, no or a low correlation has been observed.[30,66] The presence of impaired lower extremity motor control may prevent patients from achieving a vigorous-level of aerobic exercise intensity.[67]

What Performance is Documented?

The following are documented in the health record:

- Test conducted
- Distance in metres walked in 6 minutes (this is the primary outcome reported[68])
- Physical assistance provided, walking aid[68] and orthosis used, shoes worn
- Number of rests specifying seated or standing, total time the patient stopped to rest[68]
- If the patient terminates the test early, document the reason and the time walked[68]
- HR, BP, and RPE measured using the 0-10 scale[69] pre- and post-test[68]
- Distance walked as a percentage of the norm, the norm, and the norm publication source[68]
- Short- and long-term goals (STG, LTG) for test performance

Why was the 6-Minute Walk Test Chosen instead of the 2-Minute Walk Test for Use Post-Stroke?

- The 6MWT has greater capacity to differentiate patients by walking ability[70] and detect change in walking ability[57] than does the 2-minute walk test (2MWT).
- Lower extremity motor function, knee extensor strength, and fast walking speed correlate more strongly with 6MWT than 3- and 5-minute walk test performance indicating the 6MWT is a more valid measure than briefer tests of functional walking capacity.[16]
- 6MWT performance improves, on average, following task-oriented walking training,[43] treadmill training,[44] and aerobic training[45] indicating that the 6MWT is a good measure of response to these recommended treatments.[7] This is unknown for the 2MWT.
- There are published age- and sex-specific norms for at least 18 countries,[15] including Canada, Australia, and the United States, that can be used to interpret 6MWT; norms for 2MWT performance are not as widely available.
- Walking for 6 minutes provides a better indication than walking for 2 minutes of the ability to complete community activities such as grocery shopping or walking for leisure.
- The 6MWT, not the 2MWT, is recommended for use post-stroke.[9]

Why is the iWalk 6-Minute Walk Test Protocol based on the European Respiratory Society/American Thoracic Society 6-Minute Walk Test Protocol?

The American Thoracic Society (ATS) 6MWT protocol is the most widely-used protocol for people with chronic pulmonary, cardiac, and neurological conditions.[15,16,71] It was updated by the European Respiratory Society/American Thoracic Society[68] (ERS-ATS) in 2014. Revisions to the original ATS guidelines relevant to test administration post-stroke were an expansion of the list of absolute and relative contraindications for the test, and a recommendation that the evaluator walk slightly behind the patient throughout the test. The iWalk protocol is based on the ERS-ATS protocol because it:

- Provides a comprehensive screening procedure to maximize the safety of the test;
- Provides a detailed guideline of how to conduct the test; and
- Is highly reliable.[26]

What is the Test-retest Reliability of the Original ATS 6-Minute Walk Test Protocol (one trial performed with no practice trial) in People Post-Stroke?
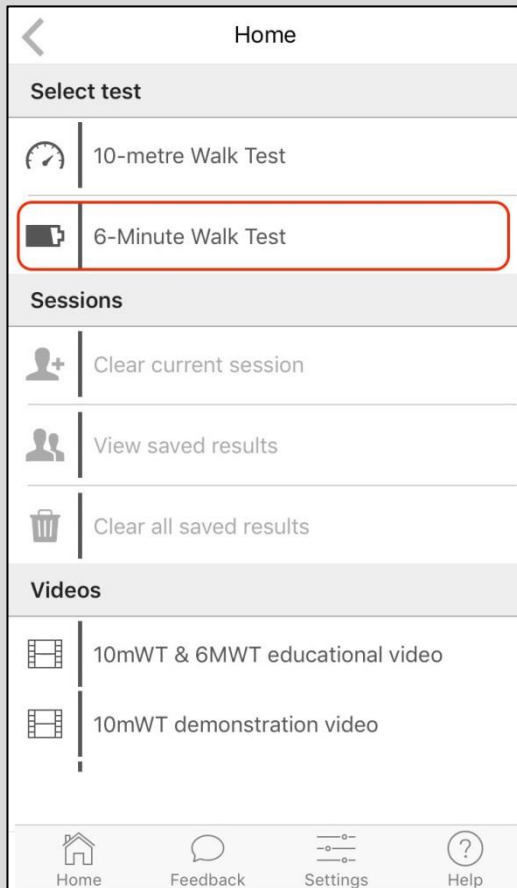

ICC = 0.98 (95% confidence interval 0.94 to 0.99)[26]

Note: ICC means intraclass correlation coefficient. ICC values ≥0.75 are considered as excellent.[3] An ICC value >0.90 is sufficient for making clinical decisions based on the individual's test performance.[4]

To follow along using iWalkAssess, go to the main menu and select "6-Minute Walk Test" and then "View Protocol"

This wall marker would be placed at the end of the 30-metre walkway. The number on the left indicates the distance in metres from the start of the walkway. The number on the right indicates the distance in metres from the end of the walkway (i.e., the return trip).

6-Minute Walk Test Protocol

1. Marking the 30-metre Walkway for the 6-Minute Walk Test

A 30-metre straight walkway on a flat, hard surface is recommended for the 6MWT to be consistent with the walkway used to generate the Canadian reference equation for normative values.[72] Place marks on the wall instead of on the floor to minimize the chance of tape removal with floor cleaning. Placing a mark every metre optimizes the accuracy of measuring walking distance and eliminates the need for a measuring wheel or tape. The evaluator should have both hands free in case the patient needs close guarding to prevent falls or physical assistance to walk or sit down.

Location:
Choose an uncluttered hallway that is preferably quiet and free of obstacles as the permanent location for the 6MWT. The air temperature should be comfortable. A rapid, appropriate response to an emergency should be available as well as a telephone or other means of calling for help.[68]

You will need:

☐ A measuring tape or metric measuring wheel to measure distances.

☐ A label maker (or white tape, scissors and ball-point pen) that you will use to create 31 labels (approximate dimensions 3 x 1 cm) to stick on the wall to mark distances.

☐ Mark two numbers on each label. The first number will indicate the distance from the start end of the walkway, and the second number will indicate the distance from the finish end of the walkway for the return trip. This way you will know how many metres the person walked the last length in either direction. For example, the first five labels would read: "0 - 30" (start mark), "1 - 29" (1 metre), "2 - 28" (2 metres), "3 - 27" (3 metres), "4 - 26" (4 metres), and so on.

Procedure:

1. Identify the start end of the walkway. Leave space behind the starting point where a patient can be seated, preferably not in front of a door.
2. Extend the measuring tape along the wall. If you're alone, you can tape the measuring tape to the floor to keep it extended and straight.
3. Place the first label marked "0 - 30" on the wall, about 30 centimetres up from the base of the wall, in line with 0 metres. The font size should be large enough to easily read the numbers when standing beside the wall.
4. Place the numbered labels at each metre along the walkway. Ideally, the labels should be permanently left on the wall. Work with the custodial staff to ensure the marks are left in place.

Alternative:
Use tape (electrical tape works well) to mark a line on the floor at the start and at each metre of the 30-metre walkway.

> **?** **DID YOU KNOW** walkway distance (but not turning direction) may influence test performance? Twenty-six people with chronic stroke walked approximately 13 metres farther and took 4 turns fewer, on average, on a 30-metre walkway than on a 20-metre walkway.[56] This demonstrates the importance of using the same walkway distance on test and re-test.

2. 6-Minute Walk Test Equipment

- ☐ 6MWT Protocol and Data Collection and Goal Setting Form on clipboard
- ☐ Measured and marked walkway
- ☐ Heart rate monitor (e.g., pulse oximeter; if not available, determine by palpation of radial artery)
- ☐ Blood pressure cuff (and stethoscope if required)
- ☐ Rating of Perceived Exertion Scale[69,73]
- ☐ 3-4 armchairs (depending on patient's functional level)

- ☐ 2 pylons to mark the ends of the walkway
- ☐ Stopwatch
- ☐ Length counter
- ☐ Pen, piece of tape or beanbag to mark where the patient stops
- ☐ Transfer belt (if needed)
- ☐ Access to a telephone in case of an emergency
- ☐ An emergency plan

> **TIP:** iWalkAssess has a timer, length counter, and the scale for rating the level of human assistance required to walk thus eliminating the need for these items.

> **TIP:** The Rating of Perceived Exertion Scale and the scale for rating the level of human assistance required to walk could be left clipped to a clipboard and hung on the BP monitor stand if one is designated for use for rehabilitation. The Rating of Perceived Exertion Scale is also available in the iWalkAssess app.

3. 6-Minute Walk Test Evaluator Qualifications

The evaluator should be trained in cardiopulmonary resuscitation and emergency and standard first aid. Training, experience, and certification in the healthcare field are preferred.[68]

4. 6-Minute Walk Test Screening

What are the screening and safety considerations?
The following screening procedures must be performed before conducting the 6MWT to enhance safety and reduce the risk of a cardiac event.

Which patients are appropriate for this test?

Patients who:

1. Can walk independently or with assistance from not more than one person. Physical assistance may include providing manual support at the waist, but not advancing the lower limb or supporting the lower limb in stance phase to avoid knee buckling. Mobility devices (e.g., cane, walker) or braces (e.g., ankle foot orthosis (AFO)) may be used. Note: a patient does not need to be able to walk continuously for 6 minutes to perform the test as the protocol allows for rests.
2. Can follow the multi-step instructions required to complete the test. Supportive communication strategies for people with aphasia and translators may be used as needed.
3. Have been diagnosed with stable exertional angina who have taken anti-angina medication and for whom rescue nitrate medication is readily available.
4. Present with any of the relative contraindications (Table 1), provided that a physician has deemed the patient safe for testing.

Table 1. Relative and absolute contraindications to administering the 6MWT

Relative Contraindications[68]	Absolute Contraindications[68,74]
Consult with a physician prior to proceeding with the test if one or more is present: – Resting HR > 120 bpm* – Resting HR < 60 bpm* – Resting Systolic BP ≥ 160 mmHg* – Resting Diastolic BP ≥100 mm Hg* – Left main coronary stenosis or its equivalent – Moderate stenotic valvular heart disease – High-degree atrioventricular block – Hypertrophic cardiomyopathy – Significant pulmonary hypertension – Advanced or complicated pregnancy – Electrolyte abnormalities – Orthopedic impairment that prevents walking – Patients with stable exertional angina have NOT taken anti-angina medication. Rescue nitrate medication is NOT readily available.	Do not conduct the test if any one of the following is present: – Myocardial infarction within 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 edema – Oxygen saturation ≤85% on room air at rest†‡ – 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

* Values are based on readings obtained after quiet sitting for at least 5 minutes in an environment free from distractions. In the event of an abnormally high reading, repeat testing after a rest interval.

† Do not conduct the test but provide the patient with supplemental oxygen.

‡ If a patient has a respiratory condition, oxygen saturation should be monitored throughout the 6MWT and the test stopped if the level falls below 80%.

When is it appropriate to conduct the 6-minute walk test after acute stroke?

Early mobilization of people post-stroke is recommended.[67] As with any other rehabilitation practice, health providers should consider the patient's medical and functional status and use their clinical judgement to determine when it is appropriate to conduct the 6MWT. The 6MWT screening procedures and guidance on how to monitor the patient's response to exercise are designed to maximize the safety of the test.

5. Conducting the 6-Minute Walk Test

Pylons:
Place a pylon just inside each end point of the walkway to cue patients to turn around.

Chairs:
Place an armchair or wheelchair at each end of the walkway. Place one or two armchairs along the walkway, as appropriate, for patients who may need to rest.

Figure 3. 6-minute walk test set-up

30 m
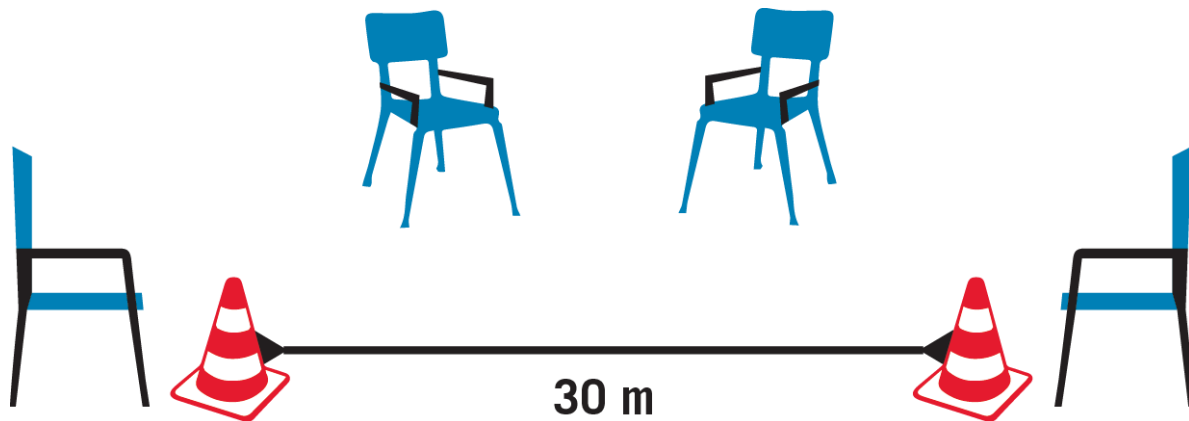
Number of times to perform test:
Once[28] (do not conduct a practice trial)

Clothing, footwear, eyewear, exercise and medication:
The evaluator should ensure that the patient wears comfortable clothing, and the **same** supportive footwear, and corrective eyewear (if applicable) on test and retest. Patients should not exercise vigorously in the two-hour period before the test. Patient should take their medications as usual.[68]
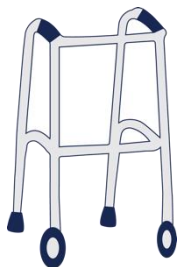
Walking aids and orthoses:
Patients should use their presently used walking aids and orthoses during the test (cane, walker, ankle foot orthosis (AFO), etc.) and this must be documented in order to compare performance.[68] Do not allow the patient to hold a handrail in the corridor if one is available. Use a transfer belt if appropriate.

> **CLINICAL NOTE:** If the patient has recently progressed to a less supportive ambulatory aid, the patient should perform the test with the ambulatory aid that he/she is most comfortable with so that test performances will be comparable.

Position of the evaluator:
Patients determine their own walking paces. The evaluator should walk on the patient's affected side and slightly behind the patient so as not to pace the patient.[68] Close supervision is required to prevent loss of balance.

Physical assistance and rests during the test:

Patients should walk independently if possible. The evaluator may provide close supervision to prevent loss of balance, and reduce the risk of falls. If necessary, physical assistance from one person (e.g., for balance, or weight-shifting) can be provided. The evaluator should provide the minimum amount of manual assistance necessary to maintain patient safety as the reliability of the test tends to be lower when physical assistance is provided.[16] The level of assistance required should be evaluated in a standardized way. We have adapted the rating scale used for the Activity Inventory of the Chedoke-McMaster Stroke Assessment[55] (CMSA) for this purpose (see below). If necessary, the patient may take rests during the test, either by sitting, standing, or leaning against a wall.

Timing and counting lengths:

When a patient is at risk of falling, the evaluator should have hands free. A stopwatch can be worn around the neck with a mechanical length counter attached to the stopwatch string. Alternately, a smartphone can be worn in a lanyard around the neck or in an armband.

A mechanical lap counter can be used to count the number of lengths

Encouragement:

Encouragement has been shown to improve test performance.[57] Thus, the evaluator provides the following standardized encouragement in even tones during the test:[68]

At 1 minute	*"You are doing well. You have 5 minutes to go."*
At 2 minutes	*"Keep up the good work. You have 4 minutes to go."*
At 3 minutes	*"You are doing well. You are halfway."*
At 4 minutes	*"Keep up the good work. You have only 2 minutes left."*
At 5 minutes	*"You are doing well. You have only 1 minute to go."*

iWalkAssess causes your phone to vibrate each minute and shows you the encouragement phrases.

DID YOU KNOW encouragement influences test performance? Forty-three people with cardiorespiratory conditions walked approximately 30.5 metres farther when standardized encouragement was given every 30 seconds compared to when no encouragement was given.[57]

Scale for Rating Level of Human Assistance Required to Walk (adapted from CMSA[55])

Level	Description of Human Assistance Required to Walk
INDEPENDENT - Another person is not required for the activity (NO HELPER).	
7	**Complete Independence -** All of the tasks which make up the activity are typically performed safely, without modification, assistive devices, or aids, and within a reasonable amount of time.
6	**Modified Independence -** One or more of the following may be true: an assistive device (e.g., foot orthoses, cane) is required to complete the task; the activity takes more than reasonable time (at least 3 times longer than normal); or there are safety (risk) considerations.
DEPENDENT - Another person is required for either supervision or physical assistance in order for the activity to be performed, or it is not performed (REQUIRES HELPER).	
Modified Dependence - The client expends half (50%) or more of the effort. The levels of assistance required are:	
5	**Supervision -** The client requires no more help than standby supervision, cueing or coaxing, without physical contact.
4	**Minimal Contact Assistance -** The client requires no more help than touching, and client expends 75% or more of the effort.
3	**Moderate Assistance -** The client requires more help than touching, or expends half (50%) or more (up to 75%) of the effort.
Complete Dependence - The client expends less than half (less than 50%) of the effort. Maximal or total assistance is required, or the activity is not performed. The levels of assistance required are:	
2	**Maximal Assistance -** The client expends less than 50% of the effort, but at least 25%.
1	**Total Assistance -** The client expends less than 25% of the effort, 2 persons are required for assistance, or the task is not tested for safety reasons.

> ⚠️ Immediately stop the test if the patient exhibits ANY one of the following:[68]
>
> 1. Chest pain
> 2. Severe dyspnea (shortness of breath)
> 3. Leg cramps
> 4. Staggering
> 5. Diaphoresis (excessive perspiration or sweating)
> 6. Pale or ashen appearance
> 7. Light-headedness
> 8. Confusion
> 9. Cyanosis (blue or grey skin colour)
> 10. Nausea
> 11. Excessive fatigue
> 12. Facial expression signifying distress
>
> The patient should sit or lie down. The evaluator should assess HR, BP and blood oxygenation. If in the hospital, the patient's nurse should be immediately notified. An evaluation by a physician should be requested if judged appropriate. The evaluator should document the reason for stopping the test in the health record.[68]

Patient Instructions and Measures Taken Pre- and Post-Test:

1. The patient begins seated at the start end of the walkway.
Record HR and BP unless measures were just taken for screening purposes. Clients should be seated comfortably for a few minutes with legs uncrossed and feet resting firmly on the floor with back supported before taking HR and BP. Take BP using the unaffected arm, supporting the forearm at the level of the heart. Obtain a rating of perceived exertion using the Rating of Perceived Exertion Scale below. Record findings.

Instructions for administering the Rating of Perceived Exertion Scale:[69]
Just before the 6MWT, show the scale to the patient and ask the patient: *"Please grade your level of exertion using this scale. By "exertion" we mean your level of effort. A zero on the scale indicates "no exertion at all". A ten on the scale indicates "maximal" exertion."* At the end of the test, ask the patient to grade their exertion level again. A printer-friendly version is available online (*refer to Online Resources: 9. Rating of Perceived Exertion Scale*). The scale is also available on the iWalkAssess app.

Rating of Perceived Exertion	
0	Nothing at all
0.5	Extremely light
1	Very light
2	Light
3	Moderate
4	Somewhat hard
5	Hard
6	
7	Very hard
8	
9	
10	Extremely hard

With iWalkAssess, you can play an audiorecording of the test instructions.

2. Provide the following instructions:
"The aim of this test is to walk as far as possible for 6 minutes. You will walk along this hallway between the pylons as many times as you can in 6 minutes. I will let you know as each minute goes past, and then at 6 minutes I will ask you to stop where you are. 6 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 start walking again as soon as you are able. Please do not talk during the test unless you have a problem, are feeling unwell or need to tell me you need a rest. You must let me know if you have any chest pain or dizziness. Now I'm going to show you."

With the patient in a seated position, the therapist demonstrates walking 30 metres and back.

3. **Ask the patient to stand at one end of the test walkway. This is the start position.** Say: *"Remember that the objective is to walk AS FAR AS POSSIBLE for 6 minutes, but don't run or jog. Do you have any questions? When you are ready, please begin."*

4. **Start timing once the patient starts walking.**

5. **If the patient chooses to sit down or lean against the wall to stop and rest:** Continue timing. Every 30 seconds, say: *"Please start walking again whenever you feel able."*

   *The time at which the patient stops and starts walking again should be documented.

6. **When 6 minutes have passed, tell the patient** *"Please stop where you are."* Mark the exact spot where the patient stopped by placing a pen, piece of tape, or bean bag on the floor. Assist the patient to the nearest chair.

7. **If the patient stops the test before 6 minutes have passed.**
   If the patient stops before the 6 minutes are up and cannot continue (or you decide that the patient should not continue), mark the spot, assist the patient to the nearest chair, and document the time stopped, and the reason for stopping.

8. **With the patient seated:**

   First, take HR and obtain a rating of perceived exertion as soon as possible as these can change quickly after exertion is stopped. Take BP last as it takes the longest to measure. Record findings on the data collection form or in the iWalkAssess app.

9. **Round the distance walked on the last length to the nearest metre and calculate the 6MWT distance as follows:**

Distance (metres) = (# lengths completed x walkway distance) + partial distance on final length

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Document the distance walked on the data collection form or in the iWalkAssess app. Refer to *Online Resources: 10. 6MWT Data Collection and Goal Setting Form*.

10. **In the patient's health record,** document walk test performed with walkway distance indicated (i.e., $6MWT_{30m}$), distance walked, test details (i.e., assistance level, walking aid and orthosis used, shoes worn, RPE/HR/BP pre and post, # rests) for comparison at re-test, % of norm, norm value and source, and short- and long-term goal (STG, LTG) using the following format:

iWalkAssess
calculates
walking distance
for you.

6MWT30m = XXX m (assistance level, aid used, orthosis used, shoes worn, RPE pre/post, HR pre/post, BP pre/post, # rests), % of norm (norm, source), STG, LTG

EXAMPLE: DOCUMENTING 6MWT PERFORMANCE IN THE PATIENT'S HEALTH RECORD

$6MWT_{30m}$ = 210 m (assistance=Level 5, quad cane, (L) AFO, running shoes, RPE pre/post: 0/4, HR pre/post: 66/79, BP pre-post: 101/70 - 107/63, 1 rest), 36% of norm (norm=574 m, Hill 2011), STG (2 weeks) = 241 m for drugstore visits, LTG (6 weeks) = 380 m for supermarket visits.

Normative values and goal setting are presented in *Modules 3* and *4*, respectively.

6-Minute Walk Test Instructions for People with Aphasia

The following slides and instructions can be used to instruct people with aphasia on how to perform the 6MWT. We recommend that you print the full-page slides and instructions (*refer to Online Resources: 8. 6-Minute Walk Test Instructions for People with Aphasia*), place each page in a plastic cover and keep them held together with a ring for use with patients. Store the slides in a designated location.

Figure 4. Slides and instructions for administering the 6MWT to people with aphasia

Walk around

1

Show slide 1. Trace the walking path to the end and back 3 times with your finger saying *"Walk around and around"*.

Walk for 6 minutes

2

Show slide 2 and say: *"Walk for 6 minutes"*.

No talking

3

Show slide 3 and say: *"No talking"*.

Feel bad, take a break

4

Show slide 4 and use your finger to trace from the symptom to the action and say: *"If you feel bad, sit down"*.

Walk again

Show slide 5. Trace the walking path to the end and back with your finger pointing and say: *"Walk again".*

Pain

Show slide 6. Point to each point of pain, then to the stop sign and say *"Pain (point to heart) or pain (point to calf), then stop".*

After 6 minutes STOP

Show slide 7 and say: *"After 6 minutes, stop walking".*

Questions?

Show slide 8 and ask" "Questions?"

Go!

Show slide 9 and say *"Ready? Go!".* Patient performs the task.

Standardized Encouragement
Each minute provide the following standardized encouragement:

At 1 minute: *Good work, 5 minutes more.*
At 2 minutes: *Good work, 4 minutes more.*
At 3 minutes: *Good work, 3 minutes more.*
At 4 minutes: *Good work, 2 minutes more.*
At 5 minutes: *Good work, 1 minute more.*
At 6 minutes: *STOP*

As you say 5, 4, 3, 2, or 1 minute more, hold up the corresponding number of fingers.

When a patient takes a rest
If the patient takes a rest,
every 30 seconds ask:
"Can you walk now?
If the patient indicates *"yes",* then say:
"Please walk"

Follow instructions on slide.

Module 3: Interpreting Test Performance

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By the end of this module you will be able to:

✓ **Explain how to determine the level of walking deficit by comparing performance to normative values**

✓ **Describe how walk test performance relates to community living**

✓ **Describe what amount of change in walk test performance exceeds measurement error**

✓ **Describe how to communicate and document walk test performance.**

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Determining the Level of Deficit by Comparing Performance to Normative Values

You can determine the level of the deficit by comparing a patient's test performances to published "norms". "Norms" are average test performance values observed among non-disabled individuals. Walk test norms are provided by age and sex because age and sex influence performance. Expressing the test performance as a percentage of a norm quantifies **the size of the walking deficit.**

Age- and Sex-Specific Norms for the 10-metre Walk Test

In a meta-analysis of data from 41 studies, average walking speeds at a normal (i.e., comfortable) pace were reported for non-disabled men and women in each age decade (Table 1).[75] The source of norms used in clinical practice should be noted in the health record.

Table 1. Age- and sex-specific norms for walking speed at a normal (or comfortable) pace

Sex	Age in years	Number of People Tested	Average Walking Speed (metres/second)
Men	20-29	155	1.36
	30-39	83	1.43
	40-49	96	1.43
	50-59	436	1.43
	60-69	941	1.34
	70-79	3671	1.26
	80-99	1091	.97
Women	20-29	180	1.34
	30-39	104	1.34
	40-49	142	1.39
	50-59	456	1.31
	60-69	5013	1.24
	70-79	8591	1.13
	80-99	2152	0.94

Refer to *Online Resources: 11. Walking Speed Age- and Sex-Specific Normative Values* for a printer-friendly version of the normative values.

EXAMPLE 1

Ms. Chan is a 65-year-old woman who walked at **0.60 metres/second (m/s)** during the **10mWT (comfortable pace)**.

Step 1:   **Determine the 10mWT norm**
Given: age = 65, sex = female
Table 1 indicates that the norm for walking speed for women aged 60-69 years is 1.24 m/s.
10mWT Norm Speed = 1.24 m/s

Interpretation: On average, non-disabled women aged 60-69 years walk at a comfortable speed of 1.24 m/s.

Step 2:   **Express the patient's walking speed as a percentage of the norm**
Given: Ms. Chan's walking speed   = 0.60 m/s
Walking speed norm for Ms. Chan   = 1.24 m/s
Percentage of the norm   = (0.60 m/s / 1.24 m/s) x 100%
**   = 48%**

Interpretation: Ms. Chan's walking speed is **48%** of the average walking speed of non-disabled women aged 60-69 years.

What to document in the health record:
10mWT (comfortable)= 0.60 m/s (assistance level, aid used, orthosis used, shoes worn), 48% of norm (norm=1.24 m/s; Bohannon 2011), STG, LTG.

iWalkAssess provides the walking speed norm and % of the norm after you enter patient age and sex.

Age- and Sex-Specific Norms for the 6-Minute Walk Test

A study carried out in 77 non-disabled Canadians aged 45 to 85 years provided the data to formulate an equation used to determine **norms** for the 6MWT.[72] You may use the equation below to calculate the age- and sex-specific normative values for people younger than 45 years and older than 85 years; however the equation validity has not been tested for these ages.

6MWT Norm Distance (in metres) = 970.7 + (-5.5 × age in years) + (56.3 × sex*)

*Insert a value of "0" for women, and a value of "1" for men.

DID YOU KNOW reference equations provide "estimates", not perfect predictions of normative values? The equation above accounted for 49% of the variability in 6MWT distances.[72] The remaining 51% may be explained by other factors, such as height.[15] The source of a reference equation used to determine a norm should be noted in the health record.[68]

EXAMPLE 2

Mr. Grey is an 80-year-old man who walked **150 metres** during the 6MWT.

Step 1: Calculate the 6MWT norm
Given: age = 80, sex = 1 (for men)
6MWT Norm Distance = 970.7 + (–5.5 × age) + (56.3 × sex)
= 970.7 + (–5.5 × 80) + (56.3 × 1)
= 587 metres (rounded to the nearest metre)
Interpretation: On average, non-disabled 80-year-old men walk **587 metres** on the 6MWT.

Step 2: Express the patient's 6MWT distance as a percentage of the norm
Given: Mr. Grey's 6MWT performance = 150 metres
6MWT norm for Mr. Grey = 587 metres
Percentage of the norm   = (150 metres / 587 metres) x 100
= 26%
Interpretation: Mr. Grey's 6MWT performance is 26% of the average performance of non-disabled 80-year-old men.

What to document in the health record:
$6MWT_{30m}$ = 150 m (assistance level, aid used, orthosis used, shoes worn, RPE pre/post, HR pre/post, BP pre-post), 26% of norm (norm=587 m, Hill 2011), STG, LTG

iWalkAssess calculates the 6MWT norm and % of the norm after you enter patient age and sex.

Understanding how Walking Speed Relates to Community Living

Crossing the Street

A walking speed of 1.20 m/s is required to safely cross a street at most crosswalks in Canada.[76-78] Traffic officials may adjust crosswalk speeds to <u>as low as 0.90 m/s</u> in areas with a high concentration of school children or senior citizens and provide additional time for perception, reaction, and management of curbs.

You can compare your patient's walking speed measured on the 10mWT with the walking speed of 1.20 m/s required to safely cross a street.

iWalkAssess does these calculations for you.
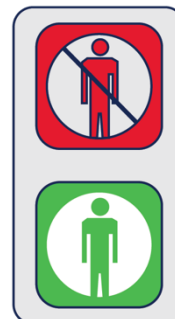
EXAMPLE 3

Mr. Gardner is a 75-year-old man who walked at a speed of **0.72 m/s** during the **10mWT**.

Express the patient's walking speed as a percentage of the crosswalk speed standard

Given: Mr. Gardner's walking speed = 0.72 m/s
Crosswalk speed standard = 1.20 m/s
Percentage of the standard = (0.72 m/s / 1.20 m/s) x 100%
= 60%

Interpretation:
Mr. Gardner walks at 60% of the speed required to safely cross a crosswalk.

Identifying Household vs Community Walkers

iWalkAssess
automatically
classifies a
patient based on
his/her walking
speed.

A study[79] of 147 ambulatory individuals that were at least 3 months post-stroke indicated that a cut-point of 0.42 m/s in walking speed separated household from community ambulators.

Table 2. Using walking speed to classify individuals as household vs community ambulators[79]

Walking Speed	Classification	Description of Ability Level
<0.40 m/s	Household Ambulator	Ranges from requiring wheelchair for bathroom and bedroom mobility to being able to use walking for all household activities but encounters difficulty with stairs and uneven terrain and needs at least supervision for both entering/exiting the house and managing curbs.
0.40 to <0.80 m/s	Limited Community Ambulator	Ranges from being independent (without supervision) in either entering/exiting the home or managing curbs; requires some assistance in both local store and uncrowded shopping centres to being able to perform without assistance (but may need supervision) in one of the following: local stores or uncrowded shopping centres.
≥0.80 m/s	Community Ambulator	Independent in all home and moderate community activities; can accept uneven terrain; and can negotiate a crowded shopping centre with supervision only.

Refer to *Online Resources: 12. Using Walking Speed to Classify Individuals as Household vs Community Ambulators* for a printer-friendly version of these reference values.

Understanding how 6MWT Performance Relates to Community Living

Table 3 presents the maximum average distance (rounded to the nearest 10 m) required to walk at community locations that older adults commonly visit.[14] Distances are approximations. Consider comparing your patient's 6MWT performance to actual distances that your patient has to walk to accomplish a preferred activity. Google maps (https://www.google.ca/maps), can be a useful tool to estimate the distances to walk between locations in your patient's community.

Table 3. Community walking distances

Location	Distance (metres)
1. Crosswalk-Residential	10
2. Crosswalk-Commercial	30
3. Gas Station	40
4. Restaurant	60
5. Post Office	80
6. Physician's Office	90
7. Bank	100
8. Religious Centre	110
9. Shopping Mall	160
10. Drugstore	330
11. Department Store	360
12. Supermarket	380
13. To Bus Stop	400
14. Superstore	610
15. Club Warehouse	680
16. To commuter train station	800

Refer to *Online Resources: 13. Distances Required to Walk at Community Locations* for a printer-friendly version of these reference values.

Explanation of How Distances in Table 3 were Measured:
Crosswalks: Distance from curb to curb.[14]
Bus stops and commuter train stations: Distance from nearest drop-off point to bus stop / commuter train station.[80,81]
Remaining community locations: Distance from an accessible parking spot through half the location and back to the parking spot.[14]

EXAMPLE 4

Ms. Florrick is a 70-year-old woman who walked **200 metres** during the 6MWT. She needs to visit her family physician regularly and she visits the drugstore once a month to fill a prescription. Table 3 indicates that she needs to walk approximately 90 metres to visit a physician's office and 330 metres to walk through the drugstore.

> **Interpretation:** Ms. Florrick is currently <u>able</u> to walk the average distance required to visit a physician's office in a reasonable amount of time (i.e., 6 minutes). Ms. Florrick is currently <u>unable</u> to walk the average distance required to walk through a drugstore in 6 minutes, and it is unclear whether it would be feasible for her to achieve a distance of 330 metres in 6 minutes.
>
> **To determine the feasibility of Ms. Florrick walking 330 metres in 6 minutes, consider:**
>
> What is the normative value for Ms. Florrick?
> Given: age = 70, sex = 0 (for women)
> 6MWT Norm Distance   = 970.7 + (–5.5 × age) + (56.3 × sex)
>   = 970.7 + (–5.5 × 70) + (56.3 × 0)
>   **= 586 metres**

Currently, Ms. Florrick is walking at **(200 metres / 586 metres) x 100 = 34% of the norm.** The goal of 380 metres is **(330 metres / 586 metres) x 100 = 56% of the norm**.

> **Interpretation:** Ms. Florrick and the therapist will have to determine whether it would be feasible for Ms. Florrick to improve from 34% to 56% of the norm, depending on Ms. Florrick's level of impairment, motivation, current treatment, comorbidity, etc. The therapist may decide to strive for a level of improvement that is less than the minimal detectable change (MDC) (refer to Goal 4 below), simply because it is achievable and will be motivating for the patient. If Ms. Florrick is unable to walk 330 metres continuously by the time of discharge, the therapist may suggest adapting the task by recommending Ms. Florrick take rests at available chairs or benches or recommend she use a shopping cart (if available) to assist her.

Determining whether Change in Walk Test Performance Reflects True Change in Ability and is Clinically Meaningful

All tests have a degree of measurement error.[2] The **Minimal Detectable Change** (MDC) is a reference value that accounts for the reliability of a measure and answers the clinical question: How much improvement in my patient's score is necessary to exceed measurement error and indicate a true change in ability? The MDC at the 90% confidence level (MDC$_{90}$) means that 90% of truly unchanged patients will display random fluctuations in performance within the range of the MDC$_{90}$ value. Change must therefore exceed the MDC$_{90}$ value to be considered as "true change" in ability.[5] If a change in score is less than the MDC$_{90}$ then the change could be partly due to measurement error. Estimates of MDC are available for the 10mWT and 6MWT post-stroke.

The **Minimal Clinically Important Difference** (MCID) is a reference value that addresses the clinical question: How much improvement do patients in my rehabilitation program need to achieve to consider the improvement as meaningful?[40] The MCID represents the smallest change in score on a measure that would be considered beneficial. The MCID should be greater than the MDC although this is not always the case.[40]

> **CLINICAL NOTE:** MDC and MCID values are not available for all levels of walking deficit or for all time periods post-stroke. Therefore, use these values as guides (not as rules) to interpreting change in walk test performance.

Table 4. MCID and MDC$_{90}$ values for 10mWT

Time Post-Stroke	Walking Pace	MCID*	MDC$_{90}$	Study Information		
				Source	Sample Size	Walking Speed at Baseline Mean ± SD
0-2 months	Comfortable	0.16 m/s		Tilson et al 2010[40]	283	0.18 ± 0.16 m/s
>6 months	Comfortable		0.17 m/s	Flansbjer et al 2005[24]	50	0.89 ± 0.30 m/s
	Fast		0.20 m/s			1.30 ± 0.50 m/s

*   The MCID value represents the change in comfortable walking speed associated with a meaningful change in level of disability defined as an improvement of ≥1 on the modified Rankin Scale.[40]

Note: Because the MCID and MDC$_{90}$ values are similar, only the MDC$_{90}$ value is used in case scenarios presented in the iWalk guide to avoid confusion.

EXAMPLE 5

At 2 weeks post-stroke, Mr. Skywalker walks at 0.25 m/s during the 10mWT. At 6 weeks post-stroke, he walks at 0.55 m/s during the 10mWT.

Difference in test performance   = 0.55 m/s - 0.25 m/s
                                                    = 0.30 m/s

Interpretation: Mr. Skywalker's walking capacity has improved because the increase in comfortable walking speed of 0.30 m/s during the 10mWT is greater than the MDC$_{90}$ value of 0.17 m/s for the 10mWT for people with chronic stroke.

Table 5. MDC$_{90}$ value for 6MWT

MDC$_{90}$	Study Information			
	Source	**Sample Size**	**Mean ± SD Baseline Walking Speed**	**Time Post-Stroke**
31 metres	Flansbjer et al 2005[24]	50	0.89 ± 0.30 m/s	>6 months

---

EXAMPLE 6A

At 3 weeks post-stroke, Ms. Fray walks 120 metres during the 6MWT. When Ms. Fray repeats the 6MWT at 5 weeks post-stroke, she walks 135 metres.

> **Difference in test performance** = 135 metres - 120 metres
> = 15 metres

Interpretation: Ms. Fray's 6MWT performance has increased by 15 metres.
We cannot say this is a true improvement in walking ability, because 15 metres is less than the MDC$_{90}$ value of 31 metres for the 6MWT. This improvement may be due to random fluctuation in 6MWT performance.

EXAMPLE 6B

At 7 weeks post-stroke, Ms. Fray walks 190 metres on the 6MWT.

> **Difference in test performance from 3 to 7 weeks** = 190 metres - 120 metres
> = 70 metres

Interpretation: Ms. Fray's functional walking capacity has improved because the increase in 6MWT performance of 70 metres is greater than the MDC$_{90}$ value of 31 metres for the 6MWT for people with chronic stroke.

Refer to *Online Resources: 14. Quick Look-Up Sheet-Reference Values for 10mWT & 6MWT* for a printer-friendly summary sheet of walk test reference values, including MDC$_{90}$, norms, walking speed of household and community ambulators, community walking distances and crosswalk speed.

Module 4: Educating and Setting Goals

By the end of this module you will be able to:

- ✓ **Describe how to provide education regarding a patient's 10-metre and 6-minute walk test performances.**
- ✓ **Explain how to negotiate and set client-centred SMART goals for the 10-metre and 6-minute walk tests.**

SMART is an acronym for:[82]

S	– specific
M	– measurable
A	– achievable
R	– realistic
T	– time-bound

Materials needed:

☐ 10-metre walk test (10mWT) and 6-minute walk test (6MWT) age- and sex-specific norms

☐ Minimal detectable change (MDC_{90}) values for the 10mWT and 6MWT

☐ Community crosswalk speed and walking distance norms

Things to Keep in Mind

If patients desire to set a goal to improve their walking ability, the following section can help to guide an approach to goal setting if it is relevant to set a goal related to improving walking distance or speed.

Educating and Setting Goals for the 10-metre Walk Test

Step 1: Interpret and Educate

Discuss with your patient how his/her 10mWT performance compares to the age- and sex- specific norm and the Canadian standard crosswalk speed of 1.20 metres/second (m/s):

"Ms. McGonagall, you walk at a speed of 0.30 m/s which is 32% of the average speed walked by women your age who have not had a stroke. This is 25% of the speed you need to cross the street safely."

Discussing your patient's performance as a percentage (%) of the norm value or crosswalk speed might be easier to understand than discussing walking speed in units of m/s.

> **CLINICAL NOTE:** Some patients may feel disheartened if their current walking ability deviates from the norm. You may choose not to share the norm values with your patient if you feel that this information may cause unnecessary emotional hardship for your patient.

Step 2: Understand Patient Priorities

Patients will be more engaged if they feel ownership for their goal rather than having the goal determined for them. This is a process of negotiation. Ask your patient:

*"Would you like to be able to walk **faster**?"*

If YES: *"What activities do you need to do that involve walking faster?"*
Example: Walk to the bathroom to prevent incontinence.

"What activities would you like to do that involve walking faster?"
Examples: Keep up with my spouse walking to the hospital cafe, keep up with my grandchildren walking in the park or zoo, crossing the street in the time of the light to get to the coffee shop.

Step 3: Negotiate a Short- and Long-Term SMART Goal

Ask your patient to suggest a short-term goal that is achievable in 2 weeks. This will help your patient to problem-solve and learn to independently set realistic goals:

"If you can walk at a speed of 0.30 m/s now, what do you think is reasonable to be able to do in 2 weeks?"

If your patient has difficulty with this process then suggest a reasonable goal for the patient. To guide goal-setting, consider:

- Can the patient improve by an amount equal to the MDC_{90} (i.e., 0.17 m/s)?
    - Short-term goal: to achieve 0.47 m/s (0.30 m/s + 0.17 m/s) in 2 weeks

- Can the patient achieve the standard speed of 1.20 m/s needed to use a crosswalk?
    - Short-term goal: to achieve 1.20 m/s in 2 weeks

Step 4: Document the Short- and Long-Term SMART Goal

Document the 10mWT goal, date by which the goal will be achieved, and the activity the patient is working toward in the patient's health record.

EXAMPLE 1: 10-METRE WALK TEST

Ms. Lestrange is a 72-year-old woman who had a stroke 8 months ago. She walked **0.60 m/s** using a quad cane on the 10mWT today.

Step 1: Interpret and Educate

Given: age = 72, sex = female, 10mWT (comfortable) = 0.60 m/s

Normal walking speed	**= 1.13 m/s**
Percentage of the norm	**= 53%**
Standard crosswalk speed	**= 1.20 m/s**
Percentage of the crosswalk speed	**= 50%**

Education statement: *"Ms. Lestrange, you walked at 0.60 m/s. This is 53% of the average speed walked by women your age who have not had a stroke. This is 50% of the speed you need to cross the street safely."*

Step 2: Understand Patient Priorities

In a discussion about setting goals, Ms. Lestrange reports that walking fast enough to cross the street during the time of a crosswalk signal is important to her. Her more urgent need relates to walking to the bathroom on time.

Step 3: Negotiate a Short- and Long-Term SMART Goal

When asked, Ms. Lestrange is unsure of a reasonable goal to achieve in 2 weeks.

You know that the MDC_{90} is 0.17 m/s for people post-stroke. **The minimum goal to exceed measurement error** = 0.60 m/s + 0.17 m/s or **0.77 m/s (or 68% of norm). Thus, you suggest Ms. Lestrange aim for walking 0.80 m/s** during the next 10mWT so that the improvement reflects a true change in ability. This will help her:

- To walk to the bathroom on time;
- To work towards the long-term goal of walking at 1.20 m/s to cross the street safely.

Educating and Setting Goals for the 6-Minute Walk Test

Step 1: Interpret and Educate

Discuss with your patient how his/her 6MWT performance compares to the age- and sex- specific norm, and community walking distance norms:

*"Mr. Snape, you walked **150 metres** (m) in 6 minutes. This is 20% of the distance walked by men your age who have not had a stroke. Here is a list of average distances needed to walk in the community. You can already walk the distance needed to cross the street, and walk from the parking lot to a restaurant, physician's office and church and back to the parking lot."*

> **CLINICAL NOTE:** Some patients may feel disheartened if their current walking ability deviates from the norm. You may choose not to share the norm values with your patient if you feel that this information may cause unnecessary emotional hardship for your patient.

Step 2: Understand Patient Priorities

Patients will be more engaged if they feel ownership for their goal rather than having the goal determined for them. This is a process of negotiation. Ask your patient:

*"Would you like to be able to walk **farther**?"*

If YES: *"What activities do you **need to do** that involve walking farther?"*
Examples: Walk from hospital room to the family room, therapy gym and hospital café, eventually, at home, walk the dog around the block, do grocery shopping, and visit the drugstore.

*"What activities would you **like to do** that involve walking farther?"*
Examples: Walking in the park, going out to dinner, visiting friends.

Step 3: Negotiate a Short- and Long-Term SMART Goal

Ask your patient to suggest a short-term goal that is achievable in 2 weeks. This will help your patient to problem-solve and learn to independently set realistic goals:

*"If you can walk **150 m** now, what do you think is reasonable to be able to do in 2 weeks?"*

If your patient has difficulty with this process then suggest a reasonable goal for the patient. To guide goal-setting, consider:

- Can the patient improve by an amount equal to the MDC_{90} (i.e., 31 m)?
  - Short-term goal: to achieve 181 m (150 m + 31 m) in 2 weeks
- Can the patient achieve an average distance needed to walk at a specific community location (e.g., 380 m to walk through a supermarket)?

- Can the patient achieve a specific distance he/she previously walked while doing an activity in the community? The distance can be determined using Google maps. Go to https://www.google.ca/maps and enter the address for the start and end location, and selecting walking as the mode of transportation (click on the symbol of the person walking). Google maps then provides a route, the distance for that route, and the number of minutes it should take a person to walk that distance.

> **?** **DID YOU KNOW** that multiple factors influence community ambulation?
> In addition to the capacity to walk a specific distance, walking in the community requires the ability to adjust walking speed and posture (e.g., changing direction), and manage different terrains, physical loads (e.g., carry a bag), ambient conditions (e.g., rain), multiple attentional demands (e.g., conversation, walk signals), and traffic density (e.g., crowds, traffic).[83]

Step 4: Document the Short- and Long-Term SMART Goal

Document the 6MWT goal, date by which the goal will be achieved, and the activity the patient is working toward (long-term goal) in the patient's health record.

EXAMPLE 2: 6-MINUTE WALK TEST

Ms. Weasley is a 72-year-old woman who had a stroke 3 months ago. She walked **325 m** using a quad cane on the 6MWT today.

Step 1: Interpret and Educate

Given: age = 72, sex = 0 (for women), $6MWT_{30m}$ = 325 m
6MWT Norm Distance = 575 m
[6MWT Norm Distance (in metres) = 970.7 + (−5.5 × age) + (56.3 × sex)]
Percentage of the norm = 57%

Education statement: *"Ms. Weasley, you walked 325 m in 6 minutes. This is 57% of the average distance walked by women your age who have not had a stroke. Here is a list of some distances needed to walk in the community. You can already walk the distance needed to cross the street, and walk from the parking lot to a restaurant, physician's office and part-way through a shopping mall."*

Step 2: Understand Patient Priorities
In a discussion about setting goals, Ms. Weasley reports that walking is very important to her but she is having trouble identifying a specific activity for which she might set a goal. After looking over the table of community walking distances, Ms. Weasley says that she wants to be able to walk to the supermarket and the superstore. She says her son can drive her to the stores, but she enjoys doing her own shopping.

Step 3: Negotiate a Short- and Long-Term SMART Goal
When asked, Ms. Weasley proposes that she could walk 100 m farther in 2 weeks. She mentions that 100 m is a quarter of the length of a running track. This means her short-term goal for the 6MWT is **425 m** (325 m + 100 m).

You tell Ms. Weasley that:
- To walk from the parking lot part-way into the supermarket and back, she will need to be able to walk approximately **380 m.**
- To walk from the parking lot part-way into the superstore and back, she will need to be able to walk approximately **610 m.**
- You know that her goal to improve by 100 metres will reflect a true change in ability as it exceeds the 6MWT MDC_{90} of 31 m for people post-stroke.

Module 5: Selecting Treatments

By the end of this module you will be able to:

✓ **Describe recommended treatments that are known to promote improved 10-metre and 6-minute walk test performance for people post-stroke.**

Which Treatments are Known to Promote Improved 10-metre and 6-Minute Walk Test Performance for People Post-Stroke?

- Aerobic training[84,85]
- Task-oriented walking training[86-88]
- Treadmill training (with or without body-weight support)[85,89-92]

These rehabilitation interventions are recommended in the *Canadian Stroke Best Practice Recommendations*[7] (Table 1) and should be considered to improve walking capacity post-stroke. Recommendations and levels of evidence are updated regularly and can be found at: http://www.strokebestpractices.ca.

Table 1. Treatments effective in improving 10-metre and 6-minute walk test performance post-stroke

Treatment	Canadian Stroke Best Practice Recommendation*
Aerobic training	Following medical clearance: Individually-tailored aerobic training involving large muscle groups should be incorporated into a comprehensive stroke rehabilitation program to enhance cardiovascular endurance (Evidence Level: Early-Level A; Late-Level A) and reduce risk of stroke recurrence (Evidence Level: Early-Level C; Late-Level C).†
Task-oriented walking training	Task and goal-oriented training that is repetitive and progressively adapted should be used to improve performance of selected lower-extremity tasks such as walking distance and speed and sit to stand (Evidence Level: Early-Level A; Late-Level A).‡
Treadmill training	Treadmill-based gait training (with or without body weight support) can be used to enhance walking speed, and distance walked when over-ground training is not available or appropriate (Evidence Level: Early-Level A; Late-Level A).

*   Early: <6 months post-stroke; Late: >6 months post-stroke.
†   For a quick guide, refer to the Aerobic Exercise after Stroke Clinician's Guide found at:
      http://www.canadianstroke.ca/wp-content/uploads/2015/03/CPSR_Guide_Clinicians-English_WEB.pdf
      For more in-depth information, refer to the AEROBICS Best Practice Recommendations found at:
      http://strokebestpractices.ca/wp-content/uploads/2013/07/AEROBICS-FINAL-July-2013.pdf
‡   Refer to the Stroke Engine found at: http://www.strokengine.ca/intervention/task-oriented-training-lower-extremitymobility

? **DID YOU KNOW** lower limb motor function and balance are significantly associated with 6-minute walk test (6MWT) performance? For 72 people with subacute stroke who walked 216 m on average on the 6MWT, the Fugl-Meyer lower limb motor score and Berg Balance Scale score explained 45% of the variability in 6MWT performances.[59] These results indicate that people who have high levels of motor function and balance also tend to walk farther during the 6MWT.

Module 6: Evaluating Practice using Audit and Feedback

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By the end of this module you will be able to:

✓ **Explain how audit and feedback can be used to evaluate adoption of new practices.**

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What is Audit and Feedback?

Audit and feedback is a widely used strategy that involves providing the individual healthcare provider with a "summary of clinical performance of healthcare over a specified time period."[93] Professional practice leaders and managers are well-positioned to undertake audit and feedback to help motivate healthcare professionals to improve their practices.

Audit and feedback entails collecting data on the performance of healthcare providers either from health records and computerized databases or by directly observing practice with patients. The results are then shared with each individual healthcare provider. Audit and feedback appears particularly effective in improving practice when the:

- Frequency at which providers are using the new practice is low,[93]
- Person delivering the feedback is a supervisor or respected colleague,[93]
- Feedback is provided more than once, in both written and verbal formats, and includes specific practice targets and suggestions for improvement.[93]

How do I Perform Audit and Feedback to Evaluate Adoption of the iWalk Toolkit into Clinical Practice?

1. **Establish a goal**

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EXAMPLE

The 10-metre walk test (10mWT) and 6-minute walk test (6MWT) will be administered on initial assessment in 90% of appropriate patients in the first 6 months, and in 100% of patients by one year.

</div>

2. Establish the frequency of the audit

> ## EXAMPLE
>
> For each physical therapist, review health records of the first five of their patients who were eligible to perform the 10mWT and the 6MWT after the start date for implementing the new practice (the same number of health records per therapist is reviewed). Check initial assessment notes to see if there is a record of administering the 10mWT and 6MWT.

3. Perform the audit

> ## EXAMPLE
>
> Professional leaders could undertake audit and feedback on the use of the 10mWT and the 6MWT and provide results two times a year. The chosen frequency is based on the importance of the practice and the feasibility of performing the audit.

4. Summarize performance and provide feedback

- Prepare a brief written summary of performance for each healthcare provider and provide it to the healthcare provider. Below is an example of a written summary:

**Audit for Use of the 10-metre and the
6-Minute Walk Test Post-Stroke**

Name of Healthcare Provider:	[enter first and last name]
Audit Period:	[enter start and end date of audit period]
Goal for implementing 10mWT:	[enter goal, e.g., 90% of patients]
Goal for implementing 6MWT:	[enter goal, e.g., 90% of patients]
Results:	
Number of health records audited:	[e.g., 5 health records of eligible patients]
Number of patients with a 10mWT:	[enter number of eligible patients who performed the 10mWT, e.g., 3 patients]
% of patients performing the 10mWT:	[enter % of eligible patients who performed the 10mWT, i.e., 60%]
Number of patients with a 6MWT:	[enter number of eligible patients who performed the 6MWT, e.g., 4 patients]
% of patients performing the 6MWT:	[enter % of eligible patients who performed the 6MWT, i.e., 80%]

---

5. Schedule a meeting with the healthcare providers involved

- Prior to the meeting, provide each person with a brief written summary of overall group performance. Determine the performance of the group by adding up the total number of appropriate patient records audited and determining the percentage of patients that performed each test. Do not identify the performance of individual healthcare providers.

6. Discuss what is going well, what can be improved, and how to make improvement

---

EXAMPLE

There is a team of three therapists. Five health records of eligible patients are audited per therapist (total 15 health records audited). Nine patients performed the 6MWT. Therefore, the group performance for the 6MWT is: (9/15) x 100 = 60%. Compare to target (e.g., 90%).

If the team did not reach the goal for implementation:

- Discuss why the team did not meet the goal.
- Understand challenges to implementation.
- Problem-solve to identify strategies to address challenges.
- Put strategies in place for therapists to achieve goals.
- Repeat audit in 4 to 6 months and evaluate progress.

TIP: It may not be feasible to perform Audit and Feedback due to a lack of human resources. In this case, therapists could still collectively set a goal for implementation, collect the iWalk data collection forms in a binder after entering the information in the health record, and meet to discuss the extent to which they think the goal is being achieved.

Potential Challenges to Implementing the 10mWT and 6MWT and Strategies to Address Them

Challenge	Strategy
"I don't feel confident to administer the test(s)."	Provide encouragement. Ask the therapist to practice the test on a colleague and observe a colleague conducting the test with a patient post-stroke. These strategies help to build self-efficacy.
"I can never find a stopwatch."	Suggest using the stopwatch in the iWalkAssess app or purchase additional stopwatches. Keep tools together in a designated location.
"I keep forgetting the MDC_{90} for the 10mWT."	Laminate and post the Quick Look-Up Guide (*refer to Online Resources: 14. Quick Look-Up Sheet: Reference Values for 10mWT & 6MWT*) in a common area and attach it to the clipboard used for testing so the values are easily accessible. Remind the therapist that the MDC_{90} values are available in the iWalkAssess app.
"I keep forgetting the reference values for walking in the community."	Laminate and post the Quick Look-Up Guide (*refer to Online Resources: 14. Quick Look-Up Sheet: Reference Values for 10mWT & 6MWT*) in a common area and attach it to the clipboard used for testing so the values are easily accessible. Remind the therapist that the reference values are available in the iWalkAssess app.
"The 6MWT is too difficult for patients post-stroke."[13]	Educate: As long as the protocol is followed, the distance the patient walks results in a valid performance. This includes cases where the patient chooses to take rest(s).
"People keep running into my patients when I administer the 6MWT."	Use a more isolated hallway if possible. If not, post a sign during tests, for example: "Walk test in progress. Please keep to the window-side of the hallway."
"The 6MWT takes too long to complete."[13]	Educate: The test, including screening, takes ~12 minutes to complete; however, it covers multiple assessments simultaneously. For example, measuring perceived exertion, heart rate and blood pressure before and after the test, and monitoring the patient during the test can be used to evaluate readiness for light intensity aerobic training.[69] You can also perform observational gait analysis during the test as long as this can be safely done. Six minutes is a realistic time frame for completing daily activities at home and is therefore a meaningful benchmark.
"I can never find the Rating of Perceived Exertion Scale when I'm ready to do the 6MWT."	Print the scale (*refer to Online Resources: 9. Rating of Perceived Exertion Scale*), place it in a plastic sleeve, attach it to a clipboard, and hang the clipboard from the blood pressure monitor if there is one reserved for rehabilitation.

Module 7: Putting it All Together with Case Scenarios

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By the end of this module you will be able to:

✓ **Demonstrate how to interpret performances, provide education and set goals for the 10-metre and 6-minute walk tests for patients post-stroke.**
✓ **Demonstrate how to use the iWalkAssess app.**

</div>

Please read the three case scenarios below and complete the activities that follow. The test performances and scores are taken from actual patients.

Case Scenario 1: Acute Care

Clinical Relevance: Performing the walk tests in acute care and comparing results to normative values provides a baseline estimate of the size of deficit. Test performance in acute care can be compared to performance during inpatient and outpatient rehabilitation to monitor response to rehabilitation and educate patients about progress. Patients can be motivated by seeing the improvement in their test performances, to see how far they've come. Documentation of test performance across the care continuum can provide data for program evaluation.

Case Scenario: Mrs. Scamander is an 85-year-old woman who had a stroke in the left hemisphere four days ago. She is able to ambulate short distances using a 4-point cane with minimal constant manual assistance to help her maintain balance, but not to advance the lower extremities. She lives with her partner in a detached home in a rural area. She enjoys hiking and staying active outdoors with a walking group. She and her partner are retired. She reports that she would like to improve her walking ability so that she can rejoin her walking group.

You are a member of the stroke team currently seeing Mrs. Scamander in the acute care neurological department of the hospital. You arrive at the patient's hospital room and find her resting in bed. Due to low patient tolerance, you completed select scales of the Chedoke-McMaster Stroke Assessment (CMSA) Impairment Inventory, and the Berg Balance Scale (BBS) during a previous assessment session. At this session you complete the 10-metre walk test (10mWT) and the 6-minute walk test (6MWT) on a 30-metre walkway. You provide minimal constant manual assistance during the 10mWT and the 6MWT to help Mrs. Scamander maintain her balance but you are careful to allow her to set her own walking pace. Mrs. Scamander is unable to walk continuously for 6 minutes and takes 3 rests in sitting during the 6MWT. The Functional Independence Measure (FIM) score is in the health record. Her results are as follows:

CASE SCENARIO 1 RESULTS

CMSA Arm: Stage 3 of 7
– Touch opposite knee
– Touch chin
– Shoulder shrugging greater than half range

CMSA Leg: Stage 3 of 7
– Adduction to neutral
– Hip flexion to 90°
– Full extension

CMSA Hand: Stage 3 of 7
– Wrist extension greater than half of the remaining range
– Finger or wrist flexion greater than half range
– Thumb to index finger

CMSA Foot: Stage 2 of 7
– Resistance to passive dorsiflexion
– Facilitated dorsiflexion or toe extension
– Facilitated plantarflexion

BBS: 15/56 (balance impairment)

FIM Score: 35/126

10mWT time: 101.26 seconds

Walking aid: 4-point cane

6MWT screen: All screening items verified based on review of the patient's health record and pre-test measures of resting HR and BP.

6MWT performance: 20 metres (3 rests in sitting), HR pre/post: 75/80, RPE pre/post: 0/3, BP pre-post: 105/72 - 108/68.

Case Scenario 2: Inpatient Rehabilitation

Clinical Relevance: Walk test performance on admission to inpatient rehabilitation can be compared to performance in acute care to judge the rate of recovery. Comparing performance to normative values and community distances/speeds on admission provides an estimate of the size of deficit, and a basis for developing walking goals, and comparing performance during outpatient rehabilitation. Knowing how their walk test performance has improved can be motivating for patients, and thinking about community walking may help prepare them for discharge home. Documentation of test performance across the care continuum can provide data for program evaluation.

Mr. Malfoy is a 78-year-old man who had a stroke in the right hemisphere one week ago. He is able to ambulate using a 4-point cane with continuous manual support at the waist to maintain balance. He lives with his partner in an apartment. Prior to his stroke, Mr. Malfoy was using a single point cane when walking outdoors. He is a retired accountant and enjoys playing cards with his neighbours. Mr. Malfoy reports that when he is discharged home, he will need to attend his medical appointments every two weeks. His partner is able to drive him to his appointments.

You are currently seeing Mr. Malfoy in the inpatient neurological rehabilitation department of the hospital. Mr. Malfoy arrives for his initial assessment wearing a track suit and running shoes. You complete select scales of the Chedoke-McMaster Stroke Assessment[55] (CMSA) Impairment Inventory, the Berg Balance Scale[94] (BBS), the 10-metre walk test (10mWT) and the 6-minute walk test (6MWT) on a 30-metre walkway. The Functional Independence Measure[95] (FIM) score is in the health record. His results are as follows:

CASE SCENARIO 2 RESULTS

CMSA Arm: Stage 3 of 7
- Touch opposite knee
- Touch chin
- Shoulder shrugging greater than half range

CMSA Hand: Stage 3 of 7
- Wrist extension greater than half of the remaining range
- Finger or wrist flexion greater than half
- Thumb to index finger

CMSA Leg: Stage 3 of 7
- Adduction to neutral
- Hip flexion to 90°
- Full extension

CMSA Foot: Stage 3 of 7
- Plantarflexion greater than half range
- Some dorsiflexion
- Extension of toes

BBS: 20/56 (balance impairment)

FIM Score: 40/126

10mWT time: 48.16 seconds

Walking aid: 4-point cane

6MWT screen: All screening items verified based on review of the patient's health record and pre-test measures of resting HR and BP.

6MWT performance: 1 length of walkway plus 21 metres on final length (1 rest in standing), HR pre/post: 76/106, RPE pre/post: 0/3, BP pre-post: 101/70 - 107/63.

Case Scenario 3: Outpatient Rehabilitation

Clinical Relevance: Although patients receiving outpatient rehabilitation may walk independently, walk test performance levels that approach normative and community ambulation values can only be achieved with advanced balance function and thus can still be a relevant goal. Knowing how their walk test performance has improved compared to performance in acute care and inpatient rehabilitation settings can be motivating for patients, and thinking about community walking may help patients think of participating in recreation/leisure activities. Documentation of test performance across the care continuum can provide data for program evaluation.

Ms. Granger is a 59-year-old woman who had a stroke in the left hemisphere three months ago. She is able to walk independently on level and non-level surfaces, stairs, etc. in the community with a single point cane. She lives alone in a one-level home and her children live nearby. She enjoys taking her grandchildren to the playground and gardening. Prior to her stroke, Ms. Granger did not use a walking aid. She worked two days a week as a greeter at a department store. She reports that she wants to be able to take the bus and walk to the department store so that she can return to work as a greeter. She says that she needs to be able to cross the street before the light changes to get to the bus stop.

You are currently seeing Ms. Granger in an outpatient neurological rehabilitation clinic. She arrives for her initial assessment wearing a track suit and running shoes. You complete select scales of the Chedoke-McMaster Stroke Assessment[55] (CMSA) Impairment Inventory, the Berg Balance Scale[94] (BBS), the 10-metre walk test (10mWT) and the 6-minute walk test (6MWT) on a 30-metre walkway. The Functional Independence Measure[95] (FIM) score at discharge from inpatient rehabilitation is in the discharge summary. Her results are as follows:

CASE SCENARIO 3 RESULTS

CMSA Arm: Stage 6 of 7
- Hand from knee to forehead 5 times in 5 seconds
- Trace vertical figure 8
- Raise arm overhead with full supination

CMSA Hand: Stage 5 of 7
- Finger flexion then extension
- Finger abduction
- Opposition of thumb to finger

CMSA Leg: Stage 7 of 7
- Sitting: Lift foot off floor 5 times in 5 seconds
- Standing: Full range internal rotation
- Standing: Trace a pattern: forward, side, back, return

CMSA Foot: Stage 6 of 7
- Standing: Tap the foot 5 times in 5 seconds
- Standing: Foot circumduction
- Standing: Eversion

BBS: 49/56 (balance impairment)

FIM Score: 88/126

10mWT time: 17.15 seconds

Walking aid: single point cane

6MWT screen: All screening items verified based on review of the patient's health record and pre-test measures of resting HR and BP.

6MWT performance: 7 lengths of walkway metres (no rests), HR pre/post: 66/79, RPE pre/post: 0/3, BP pre-post: 101/70 - 110/66.

Case Scenario Activities

To complete Activity 1 and 2, you will need:

☐ Smartphone with iWalkAssess app
☐ iWalk guide
☐ One printed copy of the following forms:

- *Online Resources: 6. 10mWT (Comfortable Pace) Data Collection and Goal Setting Form*
- *Online Resources: 10. 6MWT Data Collection and Goal Setting Form*

Activity 1: Interpreting Test Performances

1. Using the iWalkAssess app, each therapist should complete tasks 1-17 in the worksheet below for the case scenario that best reflects the types of patients he/she treats. Work alongside a partner if one is available. Refer to **Module 3** as necessary.
2. Complete the 10mWT and 6MWT Data Collection and Goal Setting Forms except for setting goals.
3. Write down how you would document test performance in the patient's health record.
4. Clear patient data from the main menu of the iWalkAssess app.
5. Repeat steps 1-4 above for 1 more case scenario of choice.

Activity 2: Educating and Setting Goals

1. Choose a partner and 2 of the 3 case scenarios. One person will be the patient from the first case scenario, and the other person will be the physical therapist. You can also complete the activity on your own, rehearsing what you would say to educate and set goals for the patient in each of the case scenarios.
2. Using role play, the physical therapist:
   - Educates the patient about their 10mWT and 6MWT performance and relevance of test performances to community living using the results you documented in activity 1 (refer to **Module 4** for suggested phrases for providing education)
   - Negotiates and sets a short- and long-term SMART goal for the 10mWT and 6MWT based on the patient's concerns stated in the case history
   - Enters the goal into the:
     – Worksheet
     – 10mWT and 6MWT Data Collection and Goal Setting Forms
3. Switch roles. One person will be the patient in the second case scenario, and the other person will be the physical therapist. Follow instructions in #2 above.

Case Scenario Worksheet: Use the iWalkAssess app to help complete the worksheet

Task	Case Scenario 1 (Mrs. Scamander)	Case Scenario 2 (Mr. Malfoy)	Case Scenario 3 (Mrs. Granger)
(Refer to Module 3 for Tasks 1-17)			
1. Date *(mm-dd-yyyy)*			
2. Age in years			
3. Sex			
4. Level of Assistance Required to Walk			
5. 10mWT walking speed			
6. 10mWT age- and sex-specific norm			
7. Performance as a % of 10mWT norm			
8. Required crosswalk speed			
9. Performance as a % of crosswalk speed			
10. Classification as household vs community ambulator			
11. 6MWT distance			
12. 6MWT age- and sex-specific norm			
13. Performance as a % of 6MWT norm			

Case Scenario Worksheet (Cont'd)

Task	Case Scenario 1 (Mrs. Scamander)	Case Scenario 2 (Mr. Malfoy)	Case Scenario 3 (Mrs. Granger)
14. Community locations currently able to walk to			
15. Preferred community locations and distance required to walk at those locations			
16. MDC_{90} for 10mWT			
17. MDC_{90} for 6MWT			
(Refer to Module 4 for Tasks 18-21)			
18. 10mWT short-term goal			
19. 10mWT long-term goal			
20. 6MWT short-term goal			
21. 6MWT long-term goal			

This is terrific. It is clearly the most comprehensive and evidence based guideline that has been developed for the 10-metre walk and 6-minute walk. The team could not have produced a more outstanding guide.
~Pamela Duncan, USA

Loved it! The documentation is clear, practical and functionally relevant. The clinical applications are widespread and user friendly. Thank you! P.S. Cannot wait to share this with my colleagues.
~Alison Muir, Canada

This is a wonderful piece of work that will benefit clinicians greatly.
~Paul Stratford, Canada

Overall the guide was very clear, concise and easy to follow. It will allow clinicians the ability to implement the use of the 6MWT and 10mWT in the clinical setting and to produce goals and treatment plans that are important to both the patient and the clinician.
~Suzanne Girling, Canada

I think this is a wonderful tool. It is well thought out, contains appropriate references, and includes suggested detailed activities to increase knowledge translation. Kudos to the authors!
~Jane Sullivan, USA

Major strengths include the clinically meaningful information, community distances, goal setting and process for therapists to learn how to use the iWalkAssess app.
~Melissa Lang, Canada

*Superb - will be a great resource for all clinicians. Love the examples and clinical scenarios.
Great way to practice.*
~Tara Klassen, Canada

Aphasia friendly instructions will be of great benefit. The majority of patients that I have in inpatient rehab that would functionally be able to complete these tests are usually profoundly aphasic.
~Nancy Lovatt, Canada

The guide is extremely well organized and easy to follow. I think it will be a wonderful resource for therapists who don't have time to pull research findings together.
~Theresa Grant, Canada

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