



Step 2 It: Improving Tolerance to Activity, Balance, and Strength

by Cella Bernier, PT, DPT

Editor's Note: This clinical case commentary is part of content for the May 2021 Journal Club and accompanies the article: Bohannon RW, Crouch RH. Two-Minute Step Test of Exercise Capacity: Systematic Review of Procedures, Performance, and Clinimetric Properties. J Geriatr Phys Ther April/June 2019. These case studies are intended to demystify the more formal statistics and format of a peer-reviewed article and translate key concepts into clinically usable information. Join us for Journal Club on the third Tuesdays of January, March, May, July, September and November at 8 pm ET to discuss current concepts with a wide range of peers.

Mr. Sussex is an 86-year-old male receiving home health physical therapy services following a 12-week stay at a rehabilitation center due to complications related to pneumonia. His primary health condition is Chronic Obstructive Pulmonary Disease (COPD). He lives alone in a single story apartment. Mr. Sussex states he is always short of breath and cannot walk even short distances without stopping to catch his breath. He would like to improve his tolerance to activity, balance, and his strength. Mr. Sussex's PT goal: he would like to walk up and down his street when possible and go to the grocery store without feeling weak or short of breath.

Past medical history is significant for recurrent pneumonia, chronic respiratory failure, dysphagia, dementia, hypertension, polyneuropathy, abdominal aortic aneurysm, osteoarthritis and frequent falls. Mr. Sussex is a previous 25 year smoker but has not smoked for more than 8 years.

Prior Level of Function

Prior to his hospitalization, Mr. Sussex ambulated up to 300 feet with use of a single point cane (SPC) and supervision for safety concerns as related to cognitive impair-

ment. He experienced moderate shortness of breath with community ambulation. In his home, he walked 50 feet at a time with use of a cane and reported minimal shortness of breath. Prior to hospitalization, he also prepared light meals for himself in the microwave without difficulty.

Physical Examination

Body Functions and Structures

Mr. Sussex presents with increased thoracic kyphosis, rounded shoulders and forward head posture. Knee extension range of motion is limited by 8 degrees on his left, 10 degrees on his right. Strength of lower extremities is as follows: Hip abduction: 2/5 bilaterally, hip extension: 3/5 bilaterally, hip flexion: 4/5 bilaterally, knee flexion: 4/5 bilaterally, knee extension: 4/5 bilaterally, plantarflexion: 2/5 bilaterally, dorsiflexion: 4/5 bilaterally. The patient has no complaint of pain at the time of the examination. He has a history of 4 falls in the week prior to his most recent hospitalization and rehab stay but has not fallen since his return home, 3 days prior to his first home PT visit.

Activity Limitations/Participation Restrictions

Sit to stand transitions are performed with use of

bilateral upper extremities and contact guard assist (CGA) due to anterior loss of balance. Stand pivot transfers are performed with use of a SPC and CGA. The patient ambulates up to 50 feet with his cane, CGA and moderate complaint of shortness of breath with a rate of perceived exertion (RPE) of 8/10. He demonstrates fair step height with poor heel strike. Mr. Sussex is unable to safely move about his kitchen to prepare meals in the microwave due to unsteadiness and shortness of breath.

Environmental Factors

Mr. Sussex's fall risk is increased due to clutter in the home and his poor understanding of the fall risk it presents. He feels he can safely navigate around boxes and cords and does not like change in his home. Caregiver support in the home is variable. He is dependent on his granddaughter for instrumental activities of daily living. She visits several times a week. He is widowed and estranged from his 6 children. A family friend visits 3 days a week to help with meal preparation and light house cleaning. A home health aide visits once a week to assist with showers. Twenty-four hour supervision has been recommended due to cognitive impairment and safety concerns. However, Mr. Sussex refuses to move in with his granddaughter, live in an assisted living, or hire caregivers to assist him further with daily activities.

Personal Factors

Mr. Sussex is unaware of his cognitive impairment and resentful of living in an apartment rather than his house. He is often anxious about personal medications, schedule changes, or slight changes in his routine each day.

Outcome Measures

Functional mobility and standing balance was assessed with the Timed Up and Go (TUG) Test and Berg Balance Scale (BBS). He performed the TUG in 23 seconds with use of a SPC and one loss of balance while turning. He used a nearby wall to steady himself. He scored 28/56 on the BBS.

The Five Times Sit-to-Stand Test was performed to assess functional lower extremity strength. The test was modified with use of his left upper extremity on a table to his left. He required 21 seconds to complete the task.

Aerobic exercise capacity was assessed with the Two-Minute Step Test (TMST). Vitals signs at rest in sitting prior to the test are as follows: blood pressure (BP) = 118/64mmHg, heart rate (HR) = 70 bpm, oxygen saturation on room air = 94%, respiratory rate = 20 breaths/minute. He required a chair on his left side for stability and one standing rest break during the assessment. He was able to lift his right lower extremity to the measured height (midway between his iliac crest and patella) 18 times. Vitals signs following the TMST were: BP = 130/65mmHg, HR = 72 bpm, oxygen saturation on room air = 94%, respiratory rate = 28 breaths/minute. His rate of perceived exertion (RPE) following the TMST was 6/10. Mr. Sussex required verbal encouragement to complete

the test, in part due to limited understanding that he was to step continuously for 2 minutes.

Due Mr. Sussex's lack of understanding during the first TMST the clinician wanted to administer the test again for a more accurate measure of aerobic capacity. However, Mr. Sussex was short of breath and complained of lower extremity fatigue following the test; the test was not administered again in the same session. During the following physical therapy session the TMST was explained again and Mr. Sussex was encouraged to step for the entire 2 minutes with the understanding that if he took a break the timer would continue. Again he used a chair on his left side for stability. Vitals prior to this TMST were as follows: BP: 132/70mmHg, HR: 60 bpm, oxygen saturation on room air: 94%, respiratory rate: 15 breaths/minute. Mr. Sussex did not stop to rest during the test and he was able to keep his feet separated to avoid tripping. He was able to raise his right knee to the measured height 47 times. Vitals following the TMST were: BP: 160/60 mmHg, HR: 66bpm, oxygen saturation on room air: 97%, respiratory rate: 28 breaths/minute. His RPE was 6/10.

Assessment/Discussion

Mr. Sussex has limited safety and independence performing sit to stand transitions, stand pivot transfers, and ambulation despite his use of a single point cane. He is also at high risk for falls based on his history of falls and increased time to complete the TUG. An increased time to complete the Five Times Sit-to-Stand Test demonstrates his limited functional lower extremity strength and increased fall risk. Limited standing balance and fall risk is apparent with his lowered BBS. Polypharmacy, cluttered home, and cognitive impairment also increase his fall risk. Impairments affecting function include kyphotic, forward head posture, decreased knee extension range of motion, limited bilateral lower extremity strength, and decreased aerobic capacity.

Mr. Sussex's lowered score on the TMST indicates a decreased aerobic capacity. Due to posterior loss of balance, Mr. Sussex required left sided support during the test, which is a permitted modification according to Rikli and Jones.¹ During his first attempt of the TMST he required a 35-second standing rest break due to shortness of breath and stating that his feet were beginning to "trip on each other". His first score of 18 steps in two minutes is significantly below the normative value of 59-91 steps in two minutes.¹

When the test instructions were fully understood during the second attempt of the TMST Mr. Sussex improved his score by 29 steps. His score of 47 steps in two minutes was much closer to normative values of 59-91 steps in 2 minutes. While his second score still supports his limited aerobic capacity there is more confidence in the results due to his improved understanding of the instructions.

Administering the test twice in one day would not have

provided the same results due to muscle fatigue and shortness of breath. Following both performances of the TMST Mr. Sussex complained more of lower extremity muscle fatigue than shortness of breath with an RPE of 6/10 after each TMST. Based on these results it would benefit a patient with cognitive impairment to have a session to practice and learn the test prior to the test being scored.

Since the test was administered over 2 sessions it was a challenge for the physical therapist to document the score in the initial examination. Charting requirements are that documentation must be submitted within 24 hours of a visit. To overcome this obstacle the physical therapist stated her intent to administer the TMST during the next session after learning occurred. The scored TMST with goals was added to the examination as an addendum.

Using the TMST in the home care setting was useful due to the limited space for other aerobic capacity assessments such as the 2-minute or 6-minute walk tests. Unfortunately, Mr. Sussex's limited understanding to perform continuous stepping during the test affected his score. Cognitive impairment could be a limiting factor for using this test. It may be helpful to allow for a practice test during one session followed by the actual test during the next visit.

Writing goals for aerobic capacity based on the TMST can be a challenge since minimal detectable change (MDC) data is unavailable. Instead, the therapist is left to use her best judgement for the patient's progression in order to form short and long-term goals. Taking into account his functional lower extremity strength and his RPE following the TMST, it appeared realistic for Mr. Sussex to improve his TMST by 5 steps in four weeks and 10 steps in eight weeks. The long-term goal for Mr. Sussex was written as follows: "By 8 weeks Mr. Sussex will demonstrate improved aerobic capacity with a TMST score of 57 steps in order to safely navigate to and from his bathroom as well as to attend MD appointments."

The TMST is a useful tool to assess aerobic capacity especially when space is limited such as in the home setting. It also allows for modifications to include more stability or standing rest periods due to shortness of breath. Based on the experience with this patient, the TMST is a viable option to assess aerobic capacity once learning is accounted for in persons with cognitive impairment. Future research to establish MDC and minimal clinically important difference (MCID) would allow clinicians to confidently establish goals for improved aerobic capacity. A better understanding of the predictive validity of the TMST would allow clinicians to link functional performance with aerobic capacity in order to improve functional mobility in daily life. The TMST has provided an objective assessment of aerobic capacity for Mr. Sussex and helped to guide physical therapy interventions and goals in the home care setting.

References

1. Rikli RE, Jones CJ. Functional fitness normative scores for community residing older adults ages 60-94. *J Aging Phys Act* 1999; 7:160-179.
2. Bohannon RW, Crouch RH. Two-Minute Step Test of Exercise Capacity: Systematic review of procedures, performance, and clinimetric properties. *J Geriatr Phys Ther* 2019;42(2):105-112.



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We will discuss **Two-Minute Step Test of Exercise Capacity: Systematic Review of Procedures, Performance, and Clinimetric Properties**; Bohannon, Richard W.; Crouch, Rebecca H. *Journal of Geriatric Physical Therapy*. 42(2):105-112, April/June 2019.

Case Study: **Step 2 It: Improving Tolerance to Activity, Balance, and Strength** by Cella Bernier PT, DPT

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Cella Bernier PT, DPT is a Board Certified Geriatric Clinical Specialist. She has 10 years of clinical experience in varied settings with an emphasis on caring for older adults. Dr. Bernier was the first graduate of the Brooks Geriatric Residency program in 2012 and currently works in the home healthcare setting in Dayton, Ohio.