

# PERFORMANCE BASED MEASUREMENTS

## 1 Background and Purpose

The assessment of physical performance incorporates aspects of strength, mobility, freedom of movement, balance and coordination. Several of these exams have been taken from procedures used in the NHANES and the EPESE studies (key in lock, chair stand, tandem stand and measured walk), while others were developed or modified specifically for CHS (computer "mouse" version of the finger-tapping test, standard shirt, medicine container and telephone number dialing).

## 2 Definitions

Tandem Stand - to stand in a position with the heel of either foot in front of and touching the toes of the opposite foot.

Orthosis - an orthopedic appliance or apparatus used to support, align, prevent or correct deformities or to improve the function of moveable parts of the body. In this exam we are specifically checking for lower extremity orthoses. This category includes plastic or metal leg braces at or above the ankle.

Prosthesis - an artificial substitute for a missing body part, such as an arm or leg, used for functional or cosmetic purposes, or both.

### 2.1 Equipment and Supplies

- 15-foot tape
- Jamar Dynamometer
- Straight-backed chair (standard for all Field Centers)
- Stop watch
- Computer, mouse and software for Finger-Tapping Test
- Key-in-lock device with pad
- Standard medication container size T20
- Standard shirts in the following sizes:
  - Men's (buttons on right) - BLUE
    - Neck size 16 (medium)
    - Neck size 18 ½ (large)
    - Neck size 20 (largest)
  - Women's (buttons on left) - PEACH
    - Misses size 12 (medium)
    - Women's size 20 (large)
    - Women's size 24 (largest)

### 3 Methods

The Performance Based Measurements are administered by a certified technician or interviewer within the flexible component of the participant flow. Interviewers or technicians are trained to administer the individual components of the exam in the following sequence:

1. The procedure is explained to the study respondent using a standardized script.
2. The procedure is demonstrated to the study respondent by the interviewer/technician.
3. The procedure is then briefly explained once again.
4. The study respondent is then asked to perform the procedure.
5. All timed procedures are begun with the words, "Ready? Go!"

All questions in the Performance Based Measurement form are coded as follows:

Check 'Yes' if the response is positive.

Check 'No' if the response is negative.

Check 'Not Assessed' if it is not possible to perform the task or to assess the particular aspect of functioning.

Check 'Not Assessed' if the individual is unwilling or unable to attempt performance of a task.

#### 3.1 TANDEM STAND AND MEASURED WALK

- Question 1 - Is the participant able to do a tandem stand (balance unaided for five seconds)?

During this test the participant may place the heel of either foot in front of the toes of the opposite foot, whichever is easier. The technician should stand next to the participant to help him/her into the tandem position; "cradle" the participant to prevent loss of balance. Female participants wearing high-heeled shoes should remove them for the tandem stand. Removal of other types of shoes is optional. "Practicing" is not allowed.

Script: "This test will assess your balance. I would like you to try to stand with the toes of one foot touching the heel of the other foot for 5 seconds, without holding on."

Demonstrate the tandem position for the participant.

Script: "Now I would like you to try to stand with the toes of one foot touching the heel of the other foot without holding on. You may use your arms, bend your knees, or move your body to maintain your balance, but try not to move your feet. Try to hold the position until I say STOP."

When the participant has his/her feet in the tandem position, ask if he/she is ready. Withdraw support and start timing as you say, "READY? GO!" Stop the stopwatch after 5 seconds or when the participant steps out of position. Stepping out of position involves moving one of the feet out of the tandem position.

Although the technician does not touch the participant during the testing period, you should be ready to provide support should the participant lose his/her balance and be at risk of falling.

If the participant is relying upon an assisting device (such as a walker, wheelchair, cane) or is using another person for balance, you may ask, "Are you able to stand in this position without using your cane/walker/wheelchair?" If the participant replies he/she is able, ask him/her to please demonstrate for you.

- Question 2 - Does the participant use an assisting device for walking?

If the response is '1 - Yes', please record the type of assisting device used:

Standard cane: A straight "stick" with a curved or straight handle which makes contact with the floor at one point.

Quad cane: A device which is similar to the standard cane at the proximal end but branches out to four "legs" at the distal end, making contact with the floor at four points. A TRIPOD CANE should be placed in this category.

Walker: A frame device upon which the user may support him/ herself with both hands.

Wheelchair

White cane

Crutches

Other: If any device other than those listed above is used, please specify in the space provided. Reliance upon another person for support does not constitute a "device."

- Question 3 - Does the participant use a lower extremity orthosis (plastic or metal leg brace at or above the ankle)?

This refers to the participant's current use of such an aid. He/she will be wearing the device at the clinic for the exam. An orthosis used at other times (at night, for

instance) is not recorded here.

An orthosis worn below the ankle (for example, a device worn in the shoes for fallen arches) does not qualify in this definition.

■ Question 4 - Is the participant missing any limb?

Major limbs only are considered here: arms (including hands) and legs (including feet). A missing finger or other digit does not constitute a missing limb. A limb is considered missing whether or not an artificial limb is replacing the natural body part.

■ Question 5 - Does the participant use a prosthesis?

If the participant is missing a limb, the use of an artificial limb or prosthesis is to be recorded here. This refers to the participant's current use of such an aid. He/she will be wearing the device at the clinic for the exam. If the participant has mentioned owning a prosthesis but is not currently wearing it, it is not to be recorded here.

■ Question 6 - Is the participant able to walk 15 feet?

A walking course of 15 feet is identified, and the beginning and ending points are marked on the floor with highly visible tape. The course should be free of obstacles.

Script: "In this test, I would like you to walk from this line to the line at the end of hall at your usual pace. Do you think you could that? Good. Let me demonstrate what I want you to do."

Demonstrate: Walk from the position behind the first line (with toes at the line) at his/her usual pace to and crossing the line 15 feet from the first.

Script: "To do this test, place your feet with your toes behind, but touching, the line where we start. When I say, "Ready, Go!", walk at your usual pace to the line at the end of the hall."

When the participant is properly at the line, say, "READY? GO!"

Start the stopwatch as the participant begins walking; stop the stopwatch when the first of the participant's feet is completely across the finish line. Be certain to count the individual steps that the participant takes.

■ Question 7 - Record the number of seconds it took the participant to walk the foot course.

- Question 8 - Record the number of steps taken to complete the course. The final step (which may exceed the final distance of the measured course) is to be counted. NOTE: Count steps taken with both the right and left feet.

### 3.2 GRIP STRENGTH

- Question 9 - Can the participant lift his/her arm to the table independently?

When implementing the grip strength test, it is necessary to ask the participant to place his/her elbow onto the table in order to use the grip strength device. Record your observation of the participant's ability to lift his/her arm/elbow onto the table independently on the form.

If the participant has lifted his/her arm/elbow as requested independently (without aid from the other hand), the answer is coded "yes" and no questions need be asked.

If the participant has not lifted his/her arm or hand to the table independently, ask: "Are you able to place your elbow onto the table without assistance from (your other hand/whatever assistance was used)?" If the participant answers "Yes," but does not perform the action, ask them to demonstrate. Record the results for each arm individually.

SPECIAL NOTE: The grip strength examination is used to test how strong the participant's hands are. Participants with one or more of the following conditions should not be tested:

1. Acute flare-up of wrist/hand; for example, arthritis, tendinitis or carpal tunnel syndrome.
2. Less than 13 weeks after surgery for fusion, arthroplasty, tendon repair or synovectomy of the upper extremity.
3. History of angina or other heart disease in the participant. Check the baseline and current event status to determine this, or ask the participant if they currently are having symptoms from heart problems. This does NOT exclude the participant from the grip strength test. Local procedures may be developed at the site to assure safety for the participant, but these procedures must be cleared through the Coordinating Center.

Script: "In this exercise, I am going to use this instrument to measure the strength in your hands."

- Question 10 - Have you had a recent worsening of pain or of arthritis in your wrist

or do you have tendinitis?

- Question 11 - Have you had any surgery on your hands or arms during the last 13 weeks?

NOTE: If either of the safety items above (Question 10 or 11) are recorded as '1 - Yes', do not perform the grip strength procedure.

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Script: "I'd like you to take your dominant arm, place your forearm on the table, and grab the two pieces of metal together like this. (Demonstrate at this point.) When I say "squeeze," squeeze as hard as you can. The two pieces of metal will not move but I will be able to read the force of your grip on the dial. I will ask you to do this three times. If you feel any pain or discomfort, tell me and we will stop."

Demonstrate: Face the participant and squeeze the dynamometer so that the participant can see the dial rotate.

Script: "Now you should place your arm on the table at right angles to your body. Grip the two pieces of metal with your dominant hand. READY? GO!" (Be sure to coach: "Squeeze, squeeze, squeeze!").

NOTE: The participant's chair should be at the proper height so that his/her arm can rest comfortably on the table at a right angle.

Repeat the examination three times in the dominant hand, then switch the dynamometer to the non-dominant hand and test grip strength three times.

The dynamometer should be set at "2" strength for testing of all participants. The computer default for this item is "2".

- Question 12 - Record whether grip strength test was done.
- Question 13 - Code which hand is being tested. (Begin with dominant hand.)
- Questions 14 through 16

Record the strength for each attempt in kilograms. Round down to the nearest kilogram. Be sure to set the dynamometer dial to zero prior to each attempt. A minimum of two attempts per hand must be made. Record 99.9 for any attempts not made.

- Question 17 - Record which hand is being used for the opposite hand test.
- Questions 18 through 20 - See Questions 14 through 16 above.

### 3.3 SINGLE CHAIR STAND

A straight backed chair without arms, with seat height of 45 cm, should be used for this test and placed against a wall for safety. The technician may stand in front of the participant with arms extended (for the participant's safety) during the chair stands.

NOTE: If the participant cannot touch the floor with his/her feet when sitting as far back as possible in the chair, a shorter chair should be used.

- Question 21 - Do you think it would be safe for you to try to stand up from a chair without using your arms?
- Question 22 - Do you think you could try to stand up from a chair without using your arms?

These are safety questions and if the response to them is negative, technician/ interviewer should record in Question 23 that the procedure was not performed due to safety reasons, for chair bound, or for other reasons.

Script: "In this test, I would like you to fold your arms across your chest. When I say, 'Ready, Go!' stand up without using your arms to assist you."

Demonstrate the procedure.

Script: "You will fold your arms and attempt to stand at my signal. Do you understand? Ready, Go!"

NOTE: The participant's feet should be placed squarely in front of him/her.

If the participant is unable to rise without using his/her arms for assistance but was able to accomplish the task when arms were used, record that information in Question 25. Also record if the participant had to shift or slide forward in the seat in order to rise. Each rocking movement or shifting of weight is counted as an attempt.

- Question 23 - If task was not completed, record the reason. Skip Questions 24 through 32 and proceed to Question 33.
- Question 24 - Record number of attempts needed to rise.
- Question 25 - Record whether participant was able to rise without using arms, rise using arms, or attempted to rise but was not able. If participant attempted but failed, go directly to Question 33.

### 3.4 REPEATED CHAIR STANDS

- Question 26 - Do you think it would be safe for you to try to stand up from a chair without using your arms, five times quickly?

This is a safety question and if the participant responds in the negative, the procedure should not be performed and the reason noted in item 27. If the participant affirms that it would be safe, proceed with the following script.

Script: "In this procedure, I want you to fold your arms across your chest and sit so that your feet are on the floor. Then try to stand up five times quickly without using your arms. Before and after the procedure, I am going to measure your heart rate."

Demonstrate: Cross your arms over your chest and sit upright in the chair. At the signal, rise 5 times, counting as you go.

- Question 28 - Record the sitting, resting heart rate of the participant.

Measure the heart rate for 30 seconds prior to asking the participant to begin the chair stands. For details regarding heart rate measurement, see Years 4-6 - Standard Seated Blood Pressure and Heart Rate Measurement in Manual of Operations.

- Question 29 - Number of completed chair rises

Script: "Now fold your arms across your chest and at my signal stand 5 times in succession, quickly, without stopping. When you stand up, come to a full standing position each time, and when you sit down, sit all the way back in the chair. I will count the number of times for you as you go. Ready, Go!" (Be sure to count: "1, 2, 3, 4, 5".)

If the participant is unable to rise without using their arms, say: "O.K., try to stand up using your arms to push off."

If participant is unable to complete the chair stands correctly (is not coming to a full stand), abort the procedure, wait 5 minutes, record the heart rate again, and begin the procedure again.

Record the number of completed chair stands. If less than 5 were completed, skip to Question 33.

- Question 30 - Record the heart rate (30 second) taken immediately following the five chair stands.



- Question 31 - Record the number of seconds required for the participant to perform the 5 chair rises. The procedure is completed with the participant sitting down following the fifth rise.
- Question 32 - Record the height of the chair in centimeters from floor to lowest point.

### 3.5 FINGER TAPPING TEST

- Question 33 - Hand done first

Script: "Now we are going to measure finger dexterity using one of our personal computers and a mouse. I'd like you to sit at the computer and get in a comfortable position. Then reach over and place your hand on the mouse. While we will eventually be measuring both hands, I'd like you to put your dominant hand on the mouse first.

Ask the participant if s/he has ever seen or used a mouse. Regardless of the participant's previous experience, assure him/her that there will be time to become familiar with the equipment.

Seat the participant at the computer in a comfortable position within easy access of the mouse. Allow the participant to handle the mouse and click it several times in order to become familiar with it. **MAKE SURE THAT THE PARTICIPANT'S WRIST OR PALM (depending on hand size) IS RESTING ON THE MOUSE OR ON THE TABLE when clicking the mouse. ONLY THE LEFT BUTTON SHOULD BE CLICKED.** The participant's wrist may NOT be extended in the air (SEE ILLUSTRATION).

While time to become familiar with the equipment is allowed, do NOT allow a practice session as fatigue may affect the score.

Record which hand is being tested first (dominant hand).

- Question 34 - Number of taps in 15 seconds

Script: "We would like you to use your index finger to tap as fast as you can on the mouse for 15 seconds. After you have tapped the first time, the computer will automatically time you and count the number of taps you can do. You will keep tapping until I tell you to stop. Let me demonstrate the procedure for you."

Demonstrate: Show the participant how to complete the procedure.

Script: "Now what I would like you to do is to place your hand on the mouse and when I say 'Ready? Go!' begin tapping. Ready, Go!"

Record the number of taps the participant made with his/her dominant hand in 15 seconds. Then have the participant repeat the procedure with the non-dominant hand and record the number of taps made.

### 3.6 KEY IN LOCK

The key in lock procedure was designed to measure manual dexterity by asking participants to pick up a key, insert it into a lock and turn it to release a dead-bolt. The key is placed on a computer mouse pad so that the surface from which the participant is picking it up is somewhat padded.

Script: "Next we will be looking at your hand function by asking you to pick up a key and open a lock. Show me which hand you would normally use to hold a key to open a lock. You may use the other hand to steady the lock but not to help you hold or turn the key. Let me demonstrate the procedure."

Demonstrate.

Script: "Although I will be timing you, I would like you to move carefully and smoothly, trying not to drop the key. Do you have any questions? Okay! Ready! Go!"

#### ■ Question 35 - Is participant able to pick up key?

If participant cannot pick up the key within 30 seconds, terminate the test and thank the participant for trying.

If answer is "yes - slid key off table," "yes-picked key up, then dropped it," "no" or "not assessed," go directly to Question 39.

#### ■ Question 36 - Is participant able to put key in lock?

Hold the unit to keep it from sliding back as the participant puts the key into the lock, or place something heavy (several books) either behind or on the base of the unit to keep it from moving.

If the answer is "no" or "not assessed," go directly to Question 39.

#### ■ Question 37 - Is participant able to open lock?

If participant cannot open the lock within two minutes, thank him/her and terminate the test.

If the answer is "no" or "not assessed," go directly to Question 39.

- Question 38 - Record number of seconds required to complete the task.

### 3.7 MEDICATION CONTAINER

The participant's ability to open a standard child-proof medication container (size T20) is assessed here. **NOTE: This is the one procedure within the performance based measures that does not require a demonstration.**

- Question 39 - Is participant able to open a standard medication container?

If participant cannot open the medicine container within 90 seconds, terminate the test and thank participant for his/her effort.

### 3.8 STANDARD SHIRT

This test assesses the participant's ability to put on a standard shirt independently and unaided.

Assess the correct gender/size of the shirt for each participant; you may ask the participant which size is appropriate if it is not readily observable.

If the participant is too large to wear the largest size, do not attempt the procedure; mark "Not assessed" on the form.

Instruct the participant to put the shirt on over the participant's own clothing. Bulky sweaters, sweatshirts, etc., should be removed first.

Begin timing the procedure when the participant accepts the shirt.

- Question 40 - Is participant able to put on shirt?

Script: I would like you to put this shirt on as you would when you are routinely dressing. After you have it on, please button it all the way from the top to the bottom. You may skip the collar button. Let me demonstrate for you.

Demonstrate.

Script: "Now you are to put the shirt on and button it from top to bottom. Do you have any questions? Fine. Ready! Go!"

The shirt is considered to be "on" if both arms are in the appropriate shirt sleeves and the collar is up around the participant's neck (not across his/her back). The buttons need not be buttoned.

If answer is "no" or "not assessed," go directly to Question 43.

- Question 41 - Is participant able to button shirt?

The participant may not stand in front of a mirror while buttoning the shirt.

If the participant misaligns the buttons and buttonholes, immediately stop the stopwatch and tell him/her to stop, unbutton the shirt, and start again. Do not time while the participant unbuttons the shirt. Begin timing again when the participant begins to button the shirt correctly.

If answer is "no" or "not assessed," go directly to Question 43.

- Question 42 - Record the number of seconds (up to 240) that the participant takes to button the shirt.

### 3.9 LEG LIFT

This tests the hip and knee flexion of the participant. The participant is asked to lift his/her leg off the ground while standing so that the thigh is at a right angle to the trunk and the knee is at a right angle to the thigh.

- Question 43 - Is participant able to lift his/her leg while standing to 90 degrees at hip and knee?

Place a hard, straight-backed chair securely facing a wall, if possible, for balance. The participant should place one hand on the chair to stabilize him/herself.

Test one leg at a time. The order in which the legs are tested, or which hand is used to hold the chair for balance, is not important.

Script: "Now I'd like you to raise your knee to make a right angle - like this. You may hold onto the chair for balance but do not use your hands or arms to raise your leg. Let me demonstrate for you."

Demonstrate.

Script: "Do you understand? You are to raise your leg to make a right angle to your body. Ready! Go!"

Score the right and left legs separately.