



Centers for Disease
Control and Prevention
National Center for
Health Statistics

2021 Balance Procedures Manual

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National Health and Nutrition Examination Survey

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1. Introduction

1.1 Background

The ability to maintain balance is essential to nearly all activities associated with daily living. The balance system enables us to sense where we are in space and to maintain our posture and equilibrium whether we are still or moving. We often do not consider balance as a “sense” in the same way that we think of seeing, hearing, tasting, smelling, and so on, because balance is usually an automatic, unconscious process. However, impairment of the balance system can be a major disabling condition for those who are affected.

The control of balance requires the integration of information from multiple sensory and motor systems by the central nervous system (CNS). Balance receptors in the inner ear (the vestibular system) provide information to the CNS about head and body movements. The eyes (visual system) provide input regarding the body’s orientation within the environment and about motion within the environment. The position and motion sensors of the muscles and joints, and the touch receptors of the extremities (proprioceptive system), send signals regarding bodily position, particularly in relation to the support surface. The CNS integrates all this information, determines the body’s spatial orientation, and sends appropriate neural messages to the motor system to activate movements that will maintain equilibrium and keep our vision clear when we are moving.

Because the balance system is so complex, it can be impaired by a large number of injuries, toxins, and disease processes affecting any of the multiple sensory inputs, neural processing centers, or motor outputs. These include (but are not limited to) infections of the inner ear, head trauma, drug or environmental toxicity, cerebrovascular insults, degenerative changes due to aging or illness, and autoimmune reactions. Balance disorders can result in a wide variety of symptoms, ranging from a generalized feeling of disorientation and disequilibrium to acute vertigo (i.e., the false sensation of motion, particularly spinning of the body or the environment). Because balance is normally an unconscious process, patients often have difficulty finding the words to explain their symptoms, and physicians can have difficulty determining the exact cause of the problem.

Impairments of the balance system are common and can be debilitating conditions. People with chronic balance disorders can be significantly disabled in many day-to-day functions, particularly

those that require stabilizing the body during weight-shifting, bending, or rapid head motion. Examples of such tasks include getting in and out of bed, taking a bath or shower, climbing stairs, and reaching for objects in high or low cabinets. Changes in body posture that require shifting one's weight or moving the head are particularly problematic and can induce vertigo. In addition, those who have balance impairments have more difficulty than nonimpaired individuals in doing tasks that involve spatial perception and movement, and often report bumping into walls, walking off a sidewalk, or veering into another lane while driving (Cohen, 1992; Cohen et al., 1995). Balance disorders restrict an individual's normal motor activities and can limit one's sense of independence, adversely affecting the quality of life (Agrawal et al., 2018).

The prevalence of balance disorders in the US is high and increases with age. Data from NHANES 2000-2004 indicate that 35.4 percent (69 million) of US adults aged 40 or older have some balance dysfunction; prevalence jumps to 69 percent among those aged 70-79 years and 85 percent among those aged 80+ years (Agrawal et al., 2009). The higher risk of balance impairments among older adults is due to functional changes associated with aging. The control of balance becomes increasingly dependent on visual and proprioceptive cues as we age, making older adults more vulnerable to falls when those orientation cues are degraded (Peterka and Black, 1990).

Individuals with balance trouble have a six-fold increase in the risk of falling; fall risk increases even further among individuals who report symptoms of dizziness (Agrawal et al., 2009). Falls are the leading cause of both fatal and nonfatal injuries among older adults (aged 65+ years). In 2014, approximately 3 million older adults sought treatment in emergency rooms for fall-related injuries; 800,000 of these patients required hospitalization and 27,000 patients died (Bergen et al., 2016). Direct medical costs of falls in the US in 2000 were more than \$19 billion (Stevens et al., 2006). Many people who fall develop a fear of falling, even if they are not injured. This fear may cause them to limit their activities, leading to reduced mobility and loss of physical fitness; this in turn increases their actual risk of falling (Vellas et al., 1997).

In addition to older adults, several other groups are at increased risk for balance dysfunction, for example, those with lower educational status, race other than White, diabetes, or hearing loss (Agrawal et al., 2009). In addition, individuals who have sustained head injuries are likely to suffer from problems with balance and dizziness (NIDCD, 1995).

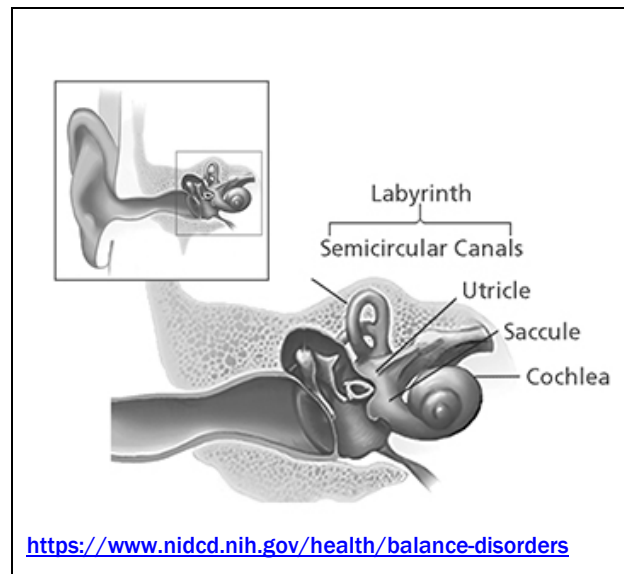
NHANES will conduct a Modified Romberg Test (MRT) of standing balance. Participants aged 20-69 years are eligible for the exam, assuming that they are not excluded for safety reasons (described elsewhere in this manual). Obtaining data from this large of an age group will allow researchers to obtain standing balance information on younger adults (ages 20-39). Nationally representative data have not previously been obtained from this age group and it is theorized that increasing levels of obesity among younger adults, as well as the disease pathologies that either cause or accompany obesity, may be reducing their standing balance function. It is imperative to measure this potentially emerging public health issue in NHANES.

1.2 Basic Anatomy of the Balance System

The body's ability to maintain balance depends on (1) inputs from three body systems (the vestibular, visual, and proprioceptive [touch] systems), (2) integration of these inputs by the CNS, and (3) appropriate responses to the integrated signal by the body's musculoskeletal system.

The primary organs of balance, the vestibular sensors, are located within the inner ear. Attached to the cochlea (the snail-shaped organ that converts sound into neural signals) are three semicircular canals. The canals are aligned to form a coordinate system, so that one canal lies in each plane (see Exhibit 1-1). The semicircular canals are encased in the temporal bone of the skull and are filled with fluid. At the base of each canal is an enlarged area called the ampulla, which contains a receptor organ called the cupulla, which contains tiny hair cells that project into the gelatinous composition of the cupulla. At the base of these hair cells are fibers from the vestibular branch of the eighth cranial nerve (CNVIII), which carries their sensory input to the CNS.

Exhibit 1-1. Structures of the balance system inside the inner ear



The fluid in the semicircular canals moves in response to angular, pivoting movements of the head, such as turning, tilting, or bending. The movement of the fluid causes the hair cells in the ampullae to bend, changing the neural signals that are sent to the brain. The fluid in each ear moves in opposite directions, so that hair cells in the ampullae are also bent in opposite directions. At the same time, the hair cells of the corresponding vestibular sensor on the left are bent in the other direction, causing fewer impulses to be sent. The brain interprets this difference in neural signals as head movement.

Between the cochlea and the semicircular canals is a space in the temporal bone called the vestibule. In this space, which is also fluid-filled, lie two organs, the utricle and saccule, which respond to linear (to-and-fro and up-and-down) motion of the head and to the force, or pull, of gravity. The utricle and saccule contain hair cells embedded in a gelatinous covering (membrane) that contains tiny crystals, called otoconia. The otoconia press against the hair cells with a pressure proportionate to the head motion and to the pull of gravity. This information is sent to the brain to enable us to maintain our spatial orientation and balance.

Information from the visual and proprioceptive systems is sent to the brain and interpreted in conjunction with the signals from the vestibular system. The brain then sends out appropriate neural impulses that stimulate reflexive actions in the musculoskeletal and ocular systems to cause the body to react as necessary to maintain balance and keep our vision clear when moving.

Sometimes the brain must decide between conflicting inputs. For example, when you suddenly stop spinning, the fluid in your semi-circular canals continues to flow for a few seconds, which tells the brain that you are still moving. However, the input from your visual system and the proprioceptive receptors tells the brain that you are not. On the other hand, when you are waiting at a stop light and the car next to you pulls slightly forward, your visual system senses that you are rolling backward. However, your vestibular system indicates that you are still at rest. When the central nervous system does not respond to each of the three inputs, it causes a sensory conflict that can result in confusion, spatial disorientation, and motion sickness and, in extreme cases, falling and injury.

1.3 Disorders of Balance

Because of the complexity of the balance system and the number of sensory and motor mechanisms that contribute toward it, there are many disorders that can disrupt normal balance function.

Disorders can be due to physical injury, illness, malformation, malnutrition, or dehydration of any part or combination of parts of the body. Disorders or damage to the semicircular canals and/or otolith organs are considered peripheral vestibular disorders, and disorders or damage to other parts of the balance system are considered central disorders. This section discusses a few of the most common causes of balance dysfunction, but should not be viewed as all-inclusive or an exhaustive list.

Peripheral vestibular disorders are caused by damage to the inner ear balance receptors and/or the nerve (CNVIII) that connects to the receptor organs. Damage can result from infection, head injury, toxicity, or other causes and can be unilateral (one-sided) or bilateral (two-sided). Unilateral disorders are more common and often result in a primary symptom of vertigo (a sensation of movement, usually spinning, which results from an imbalance in the neural signals being sent to the brain) (Strupp and Brandt, 2013). Examples of peripheral vestibular disorders include benign paroxysmal positional vertigo, Meniere's disease (an idiopathic fluctuation in ear symptoms), perilymphatic fistula (a leak of the fluid-filled inner ear), and neuritis or labyrinthitis (an inner ear infection).

Central vestibular disorders are caused by damage to the CNS areas that integrate balance information. This type of damage can result from space-occupying lesions, such as tumors or

aneurysms in the brain stem, or from degenerative brain disorders, such as multiple sclerosis, or blood-flow issues, such as atherosclerosis, migraine, or stroke. Central disorders can result in vertigo or more generalized symptoms such as lightheadedness, dizziness, unsteadiness, or ataxia (loss of muscle coordination).

Damage to the visual and/or musculoskeletal system can also result in balance impairment. Systemic disorders such as metabolic abnormalities, peripheral neuropathies, autoimmune disease, and psychogenic disturbances (e.g., anxiety disorders) are other potential etiologies of disordered balance. Moreover, it is common to find comorbidities with balance disorders, or multiple areas of disorder, damage, or weakness, which all contribute to an individual's balance dysfunction (van Leewen, et al., 2017; Balaban et al., 2011).

Depending on the etiology of the balance disorder, medical or therapeutic approaches are available to potentially eliminate or minimize the balance disorder. While few disorders are improved through medications such as diazepam (Valium) or meclizine, other disorders may be treated by dietary changes, repositioning maneuvers, or surgery. However, even if a disorder cannot be treated medically or surgically, rehabilitation therapy can often be effective in training the other contributory systems to compensate for the impaired system, and therefore reduce the intensity and duration of symptoms (Dunlap, et al., 2019).

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2. Equipment

2.1 Description of Exam Room in the MEC

The balance examination will be conducted in the balance room located in Trailer #3 and multi-purpose room #4 in Trailer #2 of the Mobile Examination Center (MEC). The room has been specially outfitted to ensure the accuracy of the exam results and the safety of examinees throughout the balance test. The room has limited visual and auditory distractions, except for the equipment used for testing, and the visual target located on the wall for fixation during eyes-open testing. Exhibit 2-1 is an example of one of the testing rooms.

The work area for the examiner consists of a small built-in table and a swing arm for the monitor, keyboard, and mouse. The rooms where the balance exam is conducted have cabinets in which equipment specific to the balance exam can be stored.

Exhibit 2-1. Exam space



2.2 Description of Equipment and Supplies

The following equipment has been supplied for the balance component of NHANES:

- **Safety Belt.** The safety belt is constructed of material that can easily be cleaned. Handles can be attached that will enable the examiner to steady the participant.
- **Sunmate Medium Density Foam Pad and Waterproof Slipcover.** The foam pad (16" x 18" x 3") provides the compliant support surface for Conditions 3, 4, and 5 of the balance test. The cover is a 4-way stretch weft-knit fabric with a polyurethane transfer coating treated against microfungi and bacteria. The slipcover is removable and


can be washed with soap and water. Stretch-4 has four-way stretch that allows it to compress with the cushion, and not detract from the cushion's support properties.

- **Digital Quartz Metronome.** The SQ200 from Seiko is a digital quartz metronome that features intuitive buttons and a rotary dial. The SQ200 Digital Quartz Metronome features a wide tempo range and 10 different beat settings. It is built with a monitor speaker, and 60 notes (C2 to B6). In addition, a 3-channel memory setting, a volume control, and several rhythm patterns are included.

An inventory of the balance equipment and supplies will be conducted at the beginning and the end of each stand. Supplies will be sent to a MEC prior to its next stand opening. Malfunctioning or missing equipment should be reported to the MEC manager and health technologist assigned to Balance.

2.3 Start of Stand Procedures

Follow the procedures below to set up the room for balance exams.

1. Remove the balance supplies from the cabinet and/or storage bench.
2. Check the floor of the room, especially in the corner designated for the balance test, to ensure it is free of debris.
3. Check both foam pads for snags or holes and place them against the wall near the area where the SP will stand for the exam.
4. Locate the metronome. At the start of every stand, put a new battery in the metronome and follow the steps below to check and, if necessary, change the settings.
 - Turn the metronome on and check the settings on the display (see Exhibit 2-2). The settings on the display should be:
 - a. Channel: METRO-1
 - b. Tempo: 60bpm
 - c. 
 - d. Beat: 0

Note: To change the tempo, rhythm, or beat, press the button for the setting that you need to change and turn the center dial.

Exhibit 2-2. Metronome settings



- Press the start button to check the volume level and adjust it as necessary.
 - Check the Velcro on the back of the metronome to make sure it is well adhered and press the metronome onto the Velcro on the wall.
 - Turn the metronome off.
5. Hang or attach the gait belt, stopwatch, wand, and USB button.

2.4 Daily Checks

At the beginning of each day, perform the checks below to make sure the room and equipment are ready for exams. Immediately report any concerns with the equipment or room to the health tech in charge of the component for the stand.

1. Log in to the computer and turn on the metronome.
2. Check the metronome to make sure it is audible and that the display is bright. If the display is dim, the batteries need to be changed.
3. Check the floor of the room, especially in the corner designated for the balance test, to ensure it is free of debris.
4. Check the foam pads for snags or holes.

2.5 Procedures at the End of an Exam Day

At the end of each exam day, Reboot/Restart the computer. (Do not shut down the computer at the end of the exam day. Selecting “shut down” turns the computer off and updates cannot be deployed.)

2.6 End of Stand Procedures

Remove the metronome from the wall and remove and dispose of the battery. After removing and disposing the battery, store the metronome in the cabinet. Remove the stopwatch from the wall and store it in the cabinet. Any equipment or supplies stored in the cabinet should be stored securely to minimize movement during transit. Secure the wand, USB button, and mouse by taping them to the desk or another stable surface. Do not unplug any cords from the computer. Store the foam pads and seat cushion in a dry area without anything on top of them. Store all other equipment and supplies in the cabinet or sitting bench. Secure the cabinet doors so they do not open during transit.

Teardown pictures of each MEC are available for a visual reference.

3. Examination Protocol

3.1 Eligibility Criteria

All examinees ages 20-69 years are eligible to participate in the balance component. There are multiple exclusionary criteria that preclude an examinee from participating in the balance component.

Participants will be excluded from the balance exam if they:

1. Have vision so poor that they need assistance to find their way to the test room (Test protocol exclusion);
2. Are pregnant (either by self-report or lab testing in the MEC [Safety exclusion]);
3. Have an amputation of the legs or feet (other than toes) (Test protocol exclusion);
4. Weigh more than 315 pounds, since the foam used to stand on during the test may become too compressed to provide a suitable surface (Test protocol exclusion);
5. Are unable to stand on their own (Safety exclusion);
6. Use a prosthetic device below the waist (Test protocol exclusion);
7. State that they are unable to do the balance test because of an injury or surgery to their legs, ankles, or feet (Safety exclusion);
8. Have experienced **both** symptoms of dizziness, lightheadedness or feeling faint in the last 24 hours **and** have fallen in the past 12 months because of problems with dizziness or balance (Safety exclusion);
9. Are wearing shoes with heels 3 inches or more (Test protocol exclusion);
10. Have a body size either too small or too large (determined when the safety belt is put on) to accommodate proper fitting of the safety belt (Safety exclusion); or
11. Say that they are not okay to begin the balance test (SP refusal).

Participants will be excluded from Condition 5 of the balance exam only if they:

1. Have neck pain, have ever had neck surgery, or have ever had a neck problem that lasted more than 6 weeks (Safety exclusion); or
2. Cannot move their head and neck comfortably in the range of motion required for the condition (Safety exclusion).

Prior to this exam, if an SP provides an unsolicited comment that they are dizzy or lightheaded, exit the balance exam. If an SP becomes dizzy during the balance test, stop the test and instruct the SP to sit in a chair (without wheels) until they are no longer dizzy or lightheaded. If an SP is or becomes dizzy or lightheaded and feels they need to be seen by the MEC clinician, refer them to the MEC clinician; otherwise, click the “Close Exam” button at the bottom of the screen to exit the Balance exam and the person can proceed with their remaining MEC components. Whenever an exam is terminated because of dizziness or lightheadedness, select “other, specify” on the Section Status screen and type “SP dizzy” or “SP lightheaded.”

3.2 Pre-Examination Procedures

3.2.1 Preliminary Activities

A few preliminary procedures should be accomplished before beginning the balance exam. When the coordinator assigns an SP to the balance component, introduce yourself and ask the SP to have a seat. Click on the log on SP button. Log on using your ID and password.

Each participant wears an identification bracelet with the participant’s identification number barcoded on it. Enter the participant’s identification number into the ISIS system by “reading” the barcode with the wand. ISIS will automatically pull up the identification screen for that examinee. Verify that the SP’s information is correct. Click “OK” to proceed with the examination.

Introduce the component using the scripts in Appendix A. It is preferable that SPs take their shoes off. If an SP has on shoes, ask them if they are able to take them off. If they are not, and the heel of their shoe is 3 inches or more, you will be able to indicate this on the ISIS screen during the exam and ISIS will skip the SP out of the balance exam.

3.2.2 Shared and Safety Exclusion Questionnaire

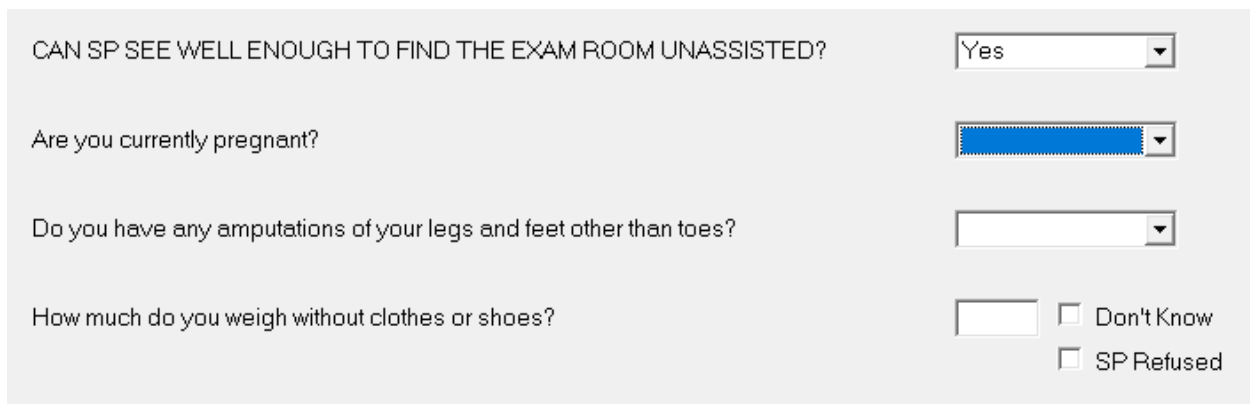
Prior to beginning the balance examination procedures, the SP is asked a series of shared and safety exclusion questions to identify conditions that may exclude the SP from part of the exam, affect how the test will be conducted, or how the results will be interpreted. ISIS will prompt you to ask the appropriate questions, and responses are entered directly into the computer. In most cases,

responses are entered from drop-down menus. To help reduce data entry errors, a pop-up message will appear when a response is entered on any screen that will exclude the SP from the exam or a portion of the exam. The message will indicate exactly what the SP will be excluded from and will allow you to review and/or change your data entry, or continue to the next screen.

Be certain to ask the questions **exactly** as they appear on the screen. Do not omit or add anything. Some questions have help text on the screen that can be read to the SP if necessary. If the SP is unsure how to answer, use the explanations below each question to help the SP determine the answer. Listen carefully to the SP's responses and make certain they are providing the information the question is seeking. If you think the SP has misunderstood the question, probe to clarify by repeating the question with a preface such as "Just to make sure I have this correct..."

To complete this section, select or enter the appropriate response for each question below. The questions on pregnancy, amputations, and weight are questions that are shared with other MEC component exams (see Exhibit 3-1). Therefore, if a person has provided this information in another component exam, ISIS will show the answer in the response space for the question in this component. If a response appears from another component, do not ask the question again.

Exhibit 3-1. Balance Shared and Safety Exclusion screen



The screenshot shows a form with four questions and their corresponding response options:

- Question: "CAN SP SEE WELL ENOUGH TO FIND THE EXAM ROOM UNASSISTED?" with a dropdown menu showing "Yes".
- Question: "Are you currently pregnant?" with a dropdown menu showing a blue patterned selection.
- Question: "Do you have any amputations of your legs and feet other than toes?" with a dropdown menu.
- Question: "How much do you weigh without clothes or shoes?" with a text input field, a "Don't Know" checkbox, and an "SP Refused" checkbox.

1. CAN SP SEE WELL ENOUGH TO FIND THE EXAM ROOM UNASSISTED?

- YES
- NO

If an SP cannot see well enough to find the exam room unassisted, they will not be able to complete the balance exam. Answering "no" will end the exam.

2. Are you currently pregnant?

YES
NO DON'T KNOW

Female SPs over the age of 60 do not receive this question. Female SPs under the age of 60 are not assigned to the component until the result of the pregnancy test is back. If the lab pregnancy test has been performed and is positive, the SP will be excluded from the component at the coordinator level. If the lab pregnancy test value is not positive, the question will prefill with the response coded in other MEC components and disable it. Women who are pregnant are excluded from the balance component.

3. Do you have any amputations of your legs and feet, other than toes?

YES REFUSED
NO DON'T KNOW

SPs with amputations of the legs or feet, other than toes, or answer “REFUSED” or “DON'T KNOW” are excluded from the balance exam.

The second screen is a continuation of the safety exclusion questions for Balance (see Exhibit 3-2).

Exhibit 3-2. Balance Shared and Safety Exclusion (2) screen

Do you weigh less than 300 pounds?

Can you stand on your own?

HELP: 'On your own' means without assistance from another person; without use of a device, such as a cane, walker, or leg brace; and without relying on support from a wall, furniture, etc.

Are you currently wearing a leg brace?

HELP: This question includes any orthotic device below the waist; it does not include extra-depth or orthopedic shoes or orthopedic inserts in shoes. It does not include a brace worn for sports.

Do you have an injury or surgery to your foot, leg, or hip that would hinder you from doing a balance test while standing?

Have you had a problem during the last 24 hours with dizziness, lightheadedness, feelings as if you are going to pass out or faint?

Have you fallen during the past 12 months due to a problem with dizziness or balance?

HELP: By falls or falling, we mean unexpectedly dropping to the floor or ground from a standing, walking, or bending position.

4. How much do you weigh without shoes or clothes?

A space is provided for you to enter the weight in pounds or to choose “REFUSED” or “DON’T KNOW.” If the response is over 315 pounds, the SP is excluded from the balance exam due to limitations of the foam pad density that will be used.

5. Do you weigh less than 300 pounds?

YES	REFUSED
NO	DON’T KNOW

SPs who refused to estimate or could not estimate how much they weigh in the previous question are asked this follow-up question. If the response is “no,” “REFUSED,” or “DON’T KNOW,” the SP is excluded from the balance exam due to limitations of the foam pad density that will be used. If the SP’s weight from body measures is more than 315 pounds, the findings will be managed at the back end when the final dataset is created.

6. Can you stand on your own?

Help: “On your own” means without assistance from another person; without use of a device, such as a cane, walker, or leg brace; and without relying on support from a wall, furniture, etc.

YES	REFUSED
NO	DON’T KNOW

Participants who cannot stand unassisted, or answer “REFUSED” or “DON’T KNOW” will be excluded from the balance exam. A person with a cane or assistive device can take the test if they think they can stand without it.

7. Are you currently wearing a leg brace?

Help: This question includes any orthotic device below the waist; it does not include extra-depth or orthopedic shoes, or orthotic inserts in shoes. It does not include a brace worn for sports.

YES	REFUSED
NO	DON’T KNOW

SPs who are wearing a leg brace, or answer “REFUSED” or “DON’T KNOW” are excluded from the balance exam.

8. Do you have an injury or surgery to your foot, leg, or hip that would hinder you from doing a balance test while standing?

YES REFUSED
NO DON'T KNOW

SPs who respond “YES,” “REFUSED,” or “DON'T KNOW” to this question are excluded from the balance exam.

9. Have you had a problem **during the last 24 hours** with dizziness, lightheadedness, feeling as if you are going to pass out or faint?

YES REFUSED
NO DON'T KNOW

10. Have you fallen **during the past 12 months** due to a problem with dizziness or balance?

Help: By falls or falling, we mean unexpectedly dropping to the floor or ground from a standing, walking, or bending position.

YES REFUSED
NO DON'T KNOW

SPs responding “YES,” “REFUSED,” or “DON'T KNOW” to BOTH questions 9 AND 10 will be excluded from the balance exam.

The third screen of safety exclusion questions consists of questions about the SP's neck (see Exhibit 3-3).

Exhibit 3-3. Balance Shared and Safety Exclusion (3) screen

Do you have neck pain now?	No
Have you ever had surgery on your neck?	
Have you ever had a neck problem that lasted more than six weeks?	
Can you comfortably move your head 30 degrees to the left and right?	

11. Do you have neck pain now?

YES	REFUSED
NO	DON'T KNOW

SPs responding “YES,” “REFUSED,” or “DON’T KNOW” are excluded from Condition 5 of the balance exam.

12. Have you ever had surgery on your neck?

YES	REFUSED
NO	DON'T KNOW

SPs responding “YES,” “REFUSED,” or “DON’T KNOW” are excluded from Condition 5 of the balance exam.

13. Have you ever had a neck problem that lasted more than six weeks?

YES	REFUSED
NO	DON'T KNOW

SPs responding “YES,” “REFUSED,” or “DON’T KNOW” are excluded from Condition 5 of the balance exam.

14. Can you comfortably move your head 30 degrees to the left and right?

YES	REFUSED
NO	DON'T KNOW

SPs responding “NO,” “REFUSED,” or “DON’T KNOW” are excluded from Condition 5 of the balance exam. If the SP is unsure, demonstrate the range of motion and allow the SP time to try it if needed.

When responses to all the questions have been entered, click the forward arrow on the navigation bar to advance to the Balance Pretest screen.

3.3 Modified Romberg Test (MRT)

3.3.1 Description of the MRT

The Modified Romberg Test of Standing Balance on Firm and Compliant Support Surfaces examines the ability of the examinee to stand unassisted under five conditions, ordered in increasing level of difficulty (Table 3-1). In Condition 1, the subject stands on the bare floor with eyes open, which allows the subject to make use of all the sensory inputs that contribute to balance—vestibular, visual, and proprioceptive. Condition 2 tests balance when only vestibular and proprioceptive information is available; the subject closes their eyes to eliminate the visual input. In Condition 3, the subject must maintain balance on a foam surface with eyes open, which reduces the proprioceptive input and leaves only visual and vestibular cues. In Condition 4, the visual input is again removed and the subject’s ability to maintain balance using only their vestibular system is tested. In Condition 5, the subject must maintain balance on a foam surface with eyes closed while slowly shaking their head side-to-side, as if saying “no.” In Condition 5, visual and proprioceptive cues are eliminated, and the vestibular system is challenged with a slow “no” movement, to better tease out any partial vestibular issues.

Table 3-1. Condition Summary table

Condition	Description
Condition 1	firm surface, eyes open
Condition 2	firm surface, eyes closed
Condition 3	foam surface, eyes open
Condition 4	foam surface, eyes closed
Condition 5	foam surface, eyes closed, head shaking left to right, slowly

Each subject is eligible for an initial test (Trial 1) and one re-test (Trial 2) to pass a specific test condition. Within each test condition, the protocol for retesting is the same as for the initial test.

Because each successive test condition from 1 to 5 is progressively more difficult than the condition preceding it, the balance testing component is ended whenever a subject fails to pass a condition or the participant refuses to proceed. During the test, be careful not to use the words “pass” and “fail” to the SP. Suggested words might be, “OK, we’re done with this part of the test.” OR “Now we can move on to the next test.” If an SP presses and says, “Did I pass?” suggested responses include, “We are just gathering information today, not interpreting the results,” or, “You gave us great data—thanks!” The examiner can remind the participant to expect the balance test results in their

final report of findings, which will be mailed to them in the coming weeks with other results from the day's visit.

3.3.2 Balance Pre-Test Questions

Before starting the test, the examiner will complete the following pre-test questions to further determine eligibility for the test (see Exhibit 3-4).

Exhibit 3-4. Balance Pre-Test Question screen

Are you okay to begin this balance test?

IS SP BAREFOOT OR WEARING SHOES WITH HEELS LESS THAN 3 INCHES?

(ASK SP TO REMOVE SHOES. IF SP WILL NOT REMOVE SHOES WITH HEELS MORE THAN 3 INCHES, MRT CANNOT BE COMPLETED.)

ABLE TO FIT SP WITH BELT?

1. Are you okay to begin this balance test?

YES REFUSED
NO DON'T KNOW

SPs responding “YES” continue to the balance exam. SPs responding “NO,” “REFUSED,” or “DON'T KNOW” are excluded from the balance exam.

2. IS SP BAREFOOT OR WEARING SHOES WITH HEELS LESS THAN 3 INCHES?

[Ask SP to remove shoes. If SP will not remove shoes with heels more than 3 inches, MRT cannot be completed.]

YES
NO

Note: This question is not asked of the SP. This question prompts you to check the SP's feet to make sure they are eligible for the test. It is preferable for the SP to complete the balance test without shoes. If the SP arrives to the balance component with shoes on, ask the SP to remove their

shoes. If the SP is unable to remove their shoes, the balance exam can still be conducted as long as the heels on the shoes are less than 3 inches. If the heels on the shoes are 3 inches or more and the SP cannot/will not remove them, the SP cannot complete the balance exam.

3. ABLE TO FIT SP WITH BELT?

YES

NO

Note: This question is not asked of the SP. The safety belt fits a wide range of waist sizes. If a proper fit cannot be obtained, the SP cannot complete the balance exam.

3.3.3 Preparation of the Examinee

Using the script in Appendix A, explain the purpose of the balance examination and what you will be doing during the test. Demonstrate the stance for the test by standing with your feet together and arms crossed on the chest. (It is also acceptable for the SPs to stand with their arms folded across the waist, holding the elbows with the hands.) This stance will be used for all conditions.

You will place the safety belt around the SP's waist. It is acceptable for the SP to assist with putting the belt around their waist. After the belt is placed on the waist, position the handles near the participant's hips. Secure the belt snugly (but not tightly) with the buckle. Ensure that the buckle is securely closed. The safety belt fits a wide range of waist sizes, however, if the subject's waist is either too large or too small for the belt to fit securely, the subject should be excluded from the exam.

Point out that the walls serve as support that will be available to the subject if they feel unsteady; and emphasize that you will be within reach at all times to prevent them from falling.

3.3.4 Positioning the SP

For each trial, the SPs will be asked to stand with their feet together and arms crossed on the chest. (It is also acceptable for the SPs to stand with their arms folded across the waist, holding the elbows with the hands.) See Exhibit 3-5.

Exhibit 3-5. Positioning of Arms



Whether the SP is standing on the floor or on the foam, proper positioning of the foot is for the SP to place their feet together with both heels and big toes touching. In rare instances, if necessary, slight deviations in the spread of feet are acceptable for SPs, who for *physical* reasons (such as obesity or leg deformity), are unable to put their feet completely together. In these rare situations, the feet should be placed as close together as possible, preferably no more than two finger-widths apart. An exception *should not* be made to make the exam easier for SPs who cannot place their feet together due to balance trouble.

When positioning the SP for the test, ensure that the SP is not so close to the wall that they don't have space to recover if they start to sway, and that they are not so far away from the wall that they have a long way to fall before hitting the wall if they cannot recover. The distance that the SP will stand from the wall will vary based on body size. Adjust where the SP stands as necessary so that the SP has between approximately 6"-8" of clearance from the wall on all sides, both at the hips and at the shoulders. The participants can use the wall to steady themselves when they are getting into position, but they cannot touch the wall once the testing begins.

3.3.5 The Five Test Conditions

This section outlines the specific procedures for each test condition, however, there are certain procedures that all test conditions have in common.

Starting the Test:

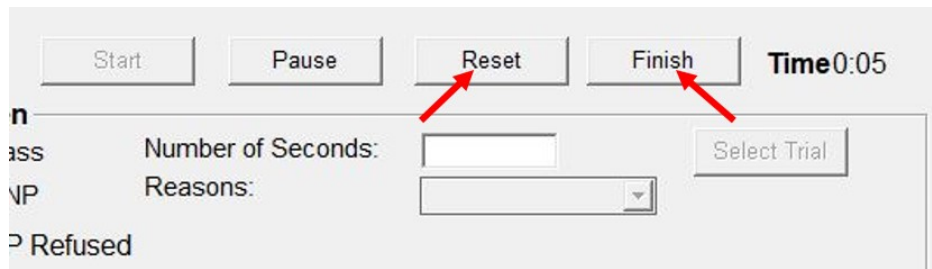
1. Direct the examinee to stand facing the visual target, and position the examinee as indicated in Section 3.3.4.
2. As indicated in the Safety Protocol section (Section 3.3.7), always assume that the SP will lose their balance. Position yourself to assist the subject should they lose their balance.

3. Stand within arm's length of the SP with a clear view of the participant.
4. Keep one hand free to assist the subject and hold the USB button in your other hand.
5. Double-check the computer to make sure everything is ready before asking the SP to stand in the test position. When the examinee has assumed the correct position, say "Begin" and then quickly press the USB button. The timer on the screen will start to run.
6. Once the trial begins, there should be no talking by anyone in the room and you should not touch the SP in any way. If you touch the SP, the trial is finished.

During the Test:

1. Do not look at the timer on the computer during the test. The timer will ding when it reaches the maximum number of seconds for each condition.
 - a. A stopwatch has been provided as a back-up to the computer timer in case an error or malfunction occurs. If you have to use the stopwatch, you will need to count in your head so you do not have to look at the stopwatch. If needed, you can use the tick of the clock in the room as your guide for counting the seconds.
2. For safety and scoring purposes, keep your eyes on the SP at all times, observing them closely throughout the trial. Exact times to failure can be read from the computer after the test is finished. As you scan the SP, remember to check to see if the SP opened their eyes during the exam for Conditions 2, 4, and 5, which counts as a fail.
3. Stop the test when the computer indicates that time is up or whenever the subject does something that constitutes a failure (see Scoring Protocol Section 3.3.6). If you need to end the test before time expires, press the USB button to pause the timer. If you press the USB button before time expires, you will have the option to select the "Reset" or "Finish" button on the screen (see Exhibit 3-6):
 - a. **Reset.** Click this button to start the trial over. This will be a rare occurrence. An example of when you would need to start a trial over is if the SP started talking after you had started the timer. Do not reset for a "fail" or for any other reason.
 - b. **Finish.** Click this button to save the time on the timer and move on to the next trial or condition. (Do not type the time in the data entry field.) **Note:** If the SP attempts the first trial for any condition, but cannot stabilize themselves enough for you to start the test, run one second off of the timer (i.e. press the USB button after 1 second has passed) to indicate that they attempted the trial. If the SP is not able or willing to make a second attempt at the trial, code "Refused" for Trial 2.

Exhibit 3-6. Features of the Examination screen



Retrial Procedures:

ISIS will determine if a retrial is necessary based on the number of seconds saved for Trial 1 of the condition. For Conditions 1 and 2, if the SP cannot stand for 15 seconds in Trial 1, ISIS will prompt you to complete a retrial. For Conditions 3-5, if the SP cannot stand for 30 seconds in Trial 1, ISIS will prompt you to complete a retrial. The trials for conditions 1 and 2 will last only for 15 seconds each. The trials for conditions 3-5 will last for 30 seconds each, however, if an SP is able to complete at least 20 seconds for either trial of a condition, they will be able to proceed to the next condition. (For example, if the SP completes 22 seconds on the first attempt of Condition 3, but only completes 15 seconds on the second attempt of Condition 3, that person will be prompted to attempt Condition 4).

If a retrial is indicated, offer to conduct a retrial of the condition by asking, “Can we try that again?” This encourages the SP to do the retrial without sounding optional or forcing the SP to do a retrial. If necessary, you may allow the subject up to 1 minute to reorient themselves between trials. If the examinee agrees to try again, click “Select Trial” for Trial 2 on the screen and repeat the condition exactly as before. If the examinee does not want to try again, select “Refused” on the ISIS screen for the remaining trials and on the Balance Examination Status screen.

If the examinee was unable to pass the first or second trial in any condition, the balance examination is over.

3.3.5.1 Test Condition 1

For Condition 1, SPs will stand on the bare floor with their eyes open. Follow the steps in Exhibit 3-7 to start the test.

Exhibit 3-7. SP positioned for Condition 1



On the ISIS screen, click “Select Trial” for Condition 1, Trial 1 (see Exhibit 3-8).

Exhibit 3-8. Balance Exam screen for Conditions 1 and 2

Condition:	Trial:	Start	Pause	Reset	Finish	Time
Condition 1 - Firm Surface, Eyes Open						
Feet together eyes open:	<input type="radio"/> Pass	Number of Seconds:	<input type="text"/>	<input type="button" value="Select Trial"/>		
	<input type="radio"/> DNP	Reasons:	<input type="text"/>			
	<input type="checkbox"/> SP Refused					
Feet together eyes open:	<input type="radio"/> Pass	Number of Seconds:	<input type="text"/>	<input type="button" value="Select Trial"/>		
	<input type="radio"/> DNP	Reasons:	<input type="text"/>			
	<input type="checkbox"/> SP Refused					
Condition 2 - Firm Surface, Eyes Closed						
Feet together eyes closed:	<input type="radio"/> Pass	Number of Seconds:	<input type="text"/>	<input type="button" value="Select Trial"/>		
	<input type="radio"/> DNP	Reasons:	<input type="text"/>			
	<input type="checkbox"/> SP Refused					
Feet together eyes closed:	<input type="radio"/> Pass	Number of Seconds:	<input type="text"/>	<input type="button" value="Select Trial"/>		
	<input type="radio"/> DNP	Reasons:	<input type="text"/>			
	<input type="checkbox"/> SP Refused					

The “Time,” located directly above the “Select Trial” button, will now have “0:00” beside it indicating that it is ready (see Exhibit 3-9).

Exhibit 3-9. Screen ready to begin Condition 1, Trial 1

Condition: 1 Trial: 1 Start Pause Reset Finish Time 0:00

Condition 1 - Firm Surface, Eyes Open

Feet together eyes open: Pass Number of Seconds: Select Trial
 DNP Reasons:

SP Refused

Feet together eyes open: Pass Number of Seconds: Select Trial
 DNP Reasons:

SP Refused

Instruct the examinee using the script in Appendix A for Condition 1. Follow the procedures previously outlined for starting the test. When the trial is over, tell the examinee, “This part of the test is over. You can relax.”

If the SP successfully completed all 15 seconds, ISIS will automatically save the number of seconds in the data entry field, code the exam as “Pass,” and prompt you to proceed to Condition 2 (see Exhibit 3-10).

Exhibit 3-10. Screen with Condition 1, Trial 1 complete

Condition: 1 Trial: 1 Start Pause Reset Finish Time 0:15

Condition 1 - Firm Surface, Eyes Open

Feet together eyes open: Pass Number of Seconds: 15 Select Trial
 DNP Reasons:

SP Refused

Feet together eyes open: Pass Number of Seconds: Select Trial
 DNP Reasons:

SP Refused

If the test was stopped before reaching 15 seconds, click “Finish” on the ISIS screen. ISIS will automatically save the number of seconds that had passed when the failure occurred in the data entry field and code the exam as DNP (did not pass). The examiner must select the reason for the failure from the drop-down list (see Exhibit 3-11). ISIS will indicate that a retrieval is necessary if the SP was not able to stand for 15 seconds. If a retrieval is necessary, follow the retrieval procedures previously outlined.

Exhibit 3-11. Selecting reason for failure from drop-down list

The screenshot shows the ISIS interface for Condition 1 - Firm Surface, Eyes Open. At the top, it displays "Condition: 1" and "Trial: 1". There are buttons for "Start", "Pause", "Reset", and "Finish", along with a "Time 0:07" indicator. Below this, the condition name "Condition 1 - Firm Surface, Eyes Open" is shown. There are two identical sets of controls for "Feet together eyes open:". Each set includes radio buttons for "Pass", "DNP", and "SP Refused". The "DNP" option is selected for both. To the right of each set is a "Number of Seconds" input field (containing "7") and a "Reasons:" dropdown menu. The dropdown menu is open, showing a list of reasons: "Feet Moved", "Arms Moved Off Waist", "Tech Intervention", and "Grab/Touch Wall". To the right of each dropdown is a "Select Trial" button.

If the examinee was unable to pass the first or second trial in Condition 1, the balance examination is over.

3.3.5.2 Test Condition 2

If the SP passes Condition 1, Condition 2 will become available for data entry (see Exhibit 3-12). For Condition 2, SPs will stand on the bare floor with their eyes closed.

Exhibit 3-12. SP positioned for Condition 2



On the ISIS screen click “Select Trial” for Condition 2, Trial 1 (see Exhibit 3-13). Instruct the examinee using the script in Appendix A for Condition 2. Follow the procedures previously outlined for starting the test.

When the trial is over, tell the examinee, “This part of the test is over. You can open your eyes and relax.” If the SP successfully completed all 15 seconds, ISIS will automatically save the number of seconds in the data entry field, code the exam as “Pass,” and prompt you to proceed to Condition 3.

Exhibit 3-13. Screen with Condition 2, Trial 1 complete

The screenshot displays the ISIS interface for a balance examination. At the top, it shows 'Condition: 2' and 'Trial: 1'. Below this are four buttons: 'Start', 'Pause', 'Reset', and 'Finish', followed by a 'Time 0:15' indicator. The interface is divided into two main sections: 'Condition 1 - Firm Surface, Eyes Open' and 'Condition 2 - Firm Surface, Eyes Closed'. Each section contains two trials. For each trial, there are three radio button options: 'Pass' (selected), 'DNP', and 'SP Refused'. To the right of these options are two input fields: 'Number of Seconds' (with a value of 15) and 'Reasons' (a dropdown menu). A 'Select Trial' button is located to the right of each trial's input fields.

If the test was stopped before reaching 15 seconds, click “Finish” on the ISIS screen. ISIS will automatically save the number of seconds that had passed when the failure occurred in the data entry field and code the exam as DNP. The examiner must select the reason for the failure from the drop-down list. ISIS will indicate that a retrieval is necessary if the SP was not able to stand for 15 seconds. If a retrieval is necessary, follow the retrieval procedures previously outlined.

If the examinee was unable to pass the first or second trial in Condition 2, the balance examination is over.

3.3.5.3 Test Condition 3

If the SP passes Condition 2, Condition 3 will become available for data entry. In Condition 3, SPs will stand on the foam pad with their eyes open (see Exhibit 3-14).

Exhibit 3-14. SP positioned for Condition 3



On the ISIS screen click “Select Trial” for Condition 3, Trial 1.

Place the foam pad on the floor where the examinee will stand for the test. Instruct the examinee using the suggested script in Appendix A for Condition 3. If necessary, demonstrate the proper stance but without standing on the foam yourself. Follow the procedures previously outlined for starting the test.

Additional notes for Condition 3:

1. Remember to make sure everything is ready before asking the SP to stand on the foam. **Never** instruct an SP while they are standing on the foam. This compresses the foam, and may cause unwanted fatigue to the participant.
2. Direct the SP to step onto the center of the foam pad, facing the visual target. **Note:** Some SPs may be unstable as they get on and off of the foam pad. If the SP is unstable, encourage the SP to hold onto the wall as they get on and off of the foam pad.
3. Do not begin until the SP is stable.

As soon as the trial is over, tell the examinee, “Step down.” Switch out the foam pad (this is necessary whether the SP moves to Condition 4 or repeats Condition 3).

If the SP successfully completed all 30 seconds, ISIS will automatically save the number of seconds in the data entry field, code the exam as “Pass,” and prompt you to proceed to Condition 4 (see Exhibit 3-15).

Exhibit 3-15. Screen with Condition 3, Trial 1 complete

The screenshot displays the ISIS interface for a balance examination. At the top, it shows 'Condition: 3' and 'Trial: 1'. There are four buttons: 'Start', 'Pause', 'Reset', and 'Finish'. A 'Time' display shows '0:30'. Below this, there are two main sections: 'Condition 3 - Foam Pad, Eyes Open' and 'Condition 4 - Foam Pad, Eyes Closed'. Each section contains two rows of settings. For Condition 3, the first row has 'Feet together eyes open' with radio buttons for 'Pass' (selected), 'DNP', and 'SP Refused'. The 'Number of Seconds' field is set to '30', and there is a 'Select Trial' button. The second row has similar settings but with 'Pass' unselected. Condition 4 has identical layout but with 'Eyes Closed' and 'Pass' unselected.

If the test was stopped before reaching 30 seconds, **click “Finish”** on the ISIS screen. ISIS will then save the number of seconds that had passed when the failure occurred in the data entry field. The examiner must select the reason for the failure from the drop-down list. If the SP completed less than 20 seconds, ISIS will automatically code the trial as “DNP.” If the SP completed 20 - 29 seconds, ISIS will automatically code the trial as “Pass.”

Upon completing trial 1, ISIS will indicate that a retrial is necessary if the SP was not able to stand for the full 30 seconds. If a retrial is necessary, switch the foam pad and follow the retrial procedures previously outlined.

If the examinee was unable to pass the first or second trial in Condition 3, the balance examination is over.

3.3.5.4 Test Condition 4

If the SP passes Condition 3, Condition 4 will become available for data entry. In Condition 4, SPs will stand on the foam pad with their eyes closed (see Exhibit 3-16).

Exhibit 3-16. SP positioned for Condition 4



On the ISIS screen click “Select Trial” for Condition 4, Trial 1.

If not already done, **switch the foam pad** and instruct the examinee using the script in Appendix A for Condition 4. Follow the procedures previously outlined for starting the test.

Additional notes for Condition 4:

1. Remember to make sure everything is ready before asking the SP to stand on the foam. **Never** instruct an SP while they are standing on the foam.
2. Direct the SP to step onto the center of the foam pad, facing the visual target. Again, be ready to help stabilize the SP if needed.
3. Do not begin until the SP is stable.

As soon as the trial is over, tell the examinee “Open your eyes and step down.”

If the SP successfully completed all 30 seconds, ISIS will automatically save the number of seconds in the data entry field, code the exam as “Pass,” and prompt you to proceed to Condition 5 (see Exhibit 3-17).

Exhibit 3-17. Screen with Condition 4, Trial 1 complete

The screenshot shows the ISIS interface for Condition 4, Trial 1. At the top, it displays "Condition: 4 Trial: 1" and a "Time: 0:30" in green. There are four buttons: "Start", "Pause", "Reset", and "Finish". Below this, there are two main sections: "Condition 3 - Foam Pad, Eyes Open" and "Condition 4 - Foam Pad, Eyes Closed". Each section contains two trials. For each trial, there are three radio button options: "Pass", "DNP", and "SP Refused". To the right of these options are two input fields: "Number of Seconds" and "Reasons". The "Number of Seconds" field for the first trial in Condition 3 is set to "30". The "Reasons" field is a dropdown menu. To the right of the "Number of Seconds" and "Reasons" fields is a "Select Trial" button. The "Time" is displayed as "0:30" in green.

If the test was stopped before reaching 30 seconds, **click “Finish”** on the ISIS screen. ISIS will then save the number of seconds that had passed when the failure occurred in the data entry field. The examiner must select the reason for the failure from the drop-down list. If the SP completed less than 20 seconds, ISIS will automatically code the trial as “DNP.” If the SP completed 20 - 29 seconds, ISIS will automatically code the trial as “Pass.”

Upon completing trial 1, ISIS will indicate that a retrial is necessary if the SP was not able to stand for the full 30 seconds. If a retrial is necessary, switch the foam pad and follow the retrial procedures previously outlined.

If the examinee was unable to pass the first or second trial in Condition 4, the balance examination is over.

3.3.5.5 Test Condition 5

If the SP passes Condition 4, Condition 5 will become available for data entry. In Condition 5, SPs will stand on the foam pad with their eyes closed and slowly shake their head left to right as if saying “no” (see Exhibit 3-18).

Exhibit 3-18. SP positioned for Condition 5



On the ISIS screen click “Select Trial” for Condition 5, Trial 1.

If not already done, **switch the foam pad** and instruct the examinee using the script in Appendix A for Condition 5. Turn on the metronome, explain to the participant that they should turn their head (right to left) to the tempo of the metronome, and follow the procedures previously outlined for starting the test.

Additional notes for Condition 5:

1. Remember to make sure everything is ready before asking the SP to stand on the foam. **Never** instruct an SP while they are standing on the foam.
2. Direct the SP to step onto the center of the foam pad, facing the visual target. Be ready to help stabilize the SP if necessary.
3. Do not begin until the SP is stable.

4. If the SP stops turning their head and does not resume, prompt the SP by saying “keep turning.” If they do not resume turning their head after prompting, stop the trial and code it as “tech intervention.”

As soon as the trial is over, tell the examinee “Stop. Open your eyes and step down.”

If the SP successfully completed all 30 seconds, ISIS will automatically save the number of seconds in the data entry field and code the exam as “Pass” (see Exhibit 3-19). Stop the metronome and advance the ISIS screen.

Exhibit 3-19. Screen with Condition 5, Trial 1 complete

The screenshot shows the ISIS software interface. At the top, it displays "Condition: 5 Trial: 1" and a "Time: 0:30" indicator. Below this, there are buttons for "Start", "Pause", "Reset", and "Finish". The main area is titled "Condition 5 - Foam Pad, Eyes Closed, Head Moving". There are two identical data entry sections. Each section has radio buttons for "Pass", "DNP", and "SP Refused". The "Number of Seconds" field is set to 30. There is a "Reasons" dropdown menu and a "Select Trial" button.

If the test was stopped before reaching 30 seconds, **click “Finish”** on the ISIS screen. ISIS will then save the number of seconds that had passed when the failure occurred in the data entry field. The examiner must select the reason for the failure from the drop-down list. If the SP completed less than 20 seconds, ISIS will automatically code the trial as “DNP.” If the SP completed 20 - 29 seconds, ISIS will automatically code the trial as “Pass.”

Upon completing trial 1, ISIS will indicate that a retrial is necessary if the SP was not able to stand for the full 30 seconds. If a retrial is necessary, switch the foam pad and follow the retrial procedures previously outlined.

After completing Condition 5, remove the safety belt from the participant and ask them to have a seat while you finish recording the results.

3.3.6 Scoring Protocol

Each trial and each condition will be scored by ISIS as either PASS or DNP based on the number of seconds the SP was able to complete for each trial. DNP is defined as any occurrence of any of the following before 15 seconds for Conditions 1 and 2, or before 20 seconds for Conditions 3-5:

- Movement of the subject’s feet from the initial test position (falling, side stepping, hopping, pivoting, etc.);
- Movement of the subject’s arms off of the chest (or waist);
- Eyes open during an eyes-closed condition (i.e., Conditions 2, 4, and 5);
- Touching the wall; or
- Any intervention by the examiner to stop the subject from falling.

Increased sway without movement of the feet does not constitute a DNP. Heels lifting off of the floor is too hard to judge, especially when the SP is standing on the foam, therefore, we will only count clear feet movement like side stepping, hopping, and pivoting (e.g. heels together but toes move apart) as a DNP. Talking within the time interval for a condition such that the examiner has to respond to the subject is cause to stop the trial and repeat it, but is not defined as a DNP. If a trial was stopped because of talking, you do not need to code anything on the ISIS screen. Reinstruct the SP about talking, click “Reset” on the ISIS screen and repeat the trial.

Scan the SP from head to toe during the test. In many situations, an SP’s reactions with the feet, arms, and eyes are nearly simultaneous. In these cases, the examiner’s best judgment must be made with respect to scoring the reason for DNP based on vigilant monitoring of the SP. Be as accurate as possible with coding.

If an SP attempts a condition but cannot get stable enough to start the condition, run one second off of the timer (i.e. press the USB button after 1 second has passed) to indicate they tried. From the drop-down list, select the reason that is closest to why the SP could not get stable. For example, if the SP could not get their feet in position without tipping over, select “Feet Moved.” If the SP could not close their eyes without losing their balance, select “Eyes Opened.”

All trials per condition will be stored in the ISIS database. The time to failure (rounded to the nearest second) will also be recorded.

3.3.7 Safety Protocol

The balance protocol is very simple and straightforward. However, a few precautionary measures are necessary to ensure the safety of examinees who may have trouble with the procedure due to their balance difficulties.

- Encourage the SP to use the wall for stability as they assume the test position and make the transition from one test condition to another, especially when stepping on and off the foam surface.
- Always stand within arm's length of the subject, with a clear view of the subject, and your hands near (but not touching) the SP.
- Always keep one hand free to assist the SP.
- Stand with one foot slightly in front of the other so that you are in a stable position if the SP starts to tip toward you.
- Ensure that the subject stands close enough to the back wall of the test room that the wall may serve to break a fall if the examinee becomes unstable.
- Err on the conservative side; even if you are unsure that an examinee is destabilizing or if you are not sure that they have recovered balance, tap the SP's arm or shoulder, and/or tell them "open your eyes" and/or "relax."
- Maintain the mindset that the subject could fall at any moment during the test.

While the mentality that an examinee could fall at any time is critical to being ready to prevent a fall, note that the following times during the test pose the greatest risk of destabilization and you should be in a stable stance with your hands up and ready:

- While the examinee is stepping onto the foam and placing their feet together;
- While the examinee is stepping off of the foam;
- During the first 3 seconds of a new test condition; and
- During Test Conditions 3, 4, and 5 (with greater risk during Conditions 4 and 5).

Report any falls immediately to the MEC Manager and Safety Officer, who will follow MEC procedures for an incident and notify the Westat Component Lead at the home office within 24 hours. The Westat Component Lead will inform the NCHS Project Officer.

3.4 Directions to Examinee

When the entire test has been completed and the SP has been closed out of the component, wait a few moments for a message from the coordinator indicating which station the SP should be directed to next. Thank the examinee and direct them to the next exam. If the examinee inquires about the results of the balance examination procedures, explain to them that you simply conduct the tests and the results will be given to them with some explanatory materials at the end of the exam.

Never interpret the results of the exam for the SP or give any indication of the test results.

3.5 Final Procedures

At the end of the exam, reset the test room for the next SP.

Appendix A
English and Spanish Scripts

Appendix A

English and Spanish Scripts

English scripts	Spanish scripts
<p>Introduction to Component Now we are going to check the things that keep you balanced when standing. First, I need to ask you some questions, then I'll explain the test.</p>	<p>Introduction to Component Ahora vamos a hacer una prueba sobre qué tan bien puede usted mantener el equilibrio estando de pie. Primero, necesito hacerle algunas preguntas. Después, le explicaré la prueba.</p>
<p>SP seated First, I'm going to show you what I want you to try, so please stay seated and watch. You're going to stand like this – arms crossed, feet together – for up to 30 seconds. (Demonstrate correct stance) You may do this several times in different ways... for example, with your eyes open or your eyes closed. I will be standing right here in case you lose your balance. I am going to put this safety belt around your waist (SHOW THE BELT) to help me steady you if you get off balance. The whole test will take several minutes. Do you have any questions?</p>	<p>SP seated Primero, le voy a mostrar lo que quiero que haga. Por favor, permanezca sentado y observe. Quiero que se pare en esta posición – los brazos cruzados sobre el pecho, y los pies juntos – hasta por 30 segundos. (Demonstrate correct stance) Es posible que tenga que hacer esto varias veces de distintas maneras... por ejemplo, con los ojos abiertos o con los ojos cerrados. Voy a permanecer de pie aquí, en caso de que pierda el equilibrio. Le voy a poner estas correas de seguridad en la cintura (SHOW THE BELT) para mantenerlo firme en caso de que pierda el equilibrio. La prueba tomará varios minutos. ¿Tiene alguna pregunta?</p>
<p>Start Condition 1: Stand on the stickers facing me. Once we start the test, do not talk. Cross your arms. Put your feet together. Look at the mark on the wall. (Do not let SP stand in any condition position while you explain the condition – let them relax.) Begin. (Quickly press the USB button.)</p>	<p>Start Condition 1: Párese sobre las etiquetas, mirándome. Cuando empecemos la prueba, por favor, no hable. Ponga los brazos cruzados sobre el pecho. Ponga los pies juntos. Mire la marca en la pared. (Do not let SP stand in any condition position while you explain the condition – let them relax.) Comience. (Quickly press the USB button.)</p>
<p>Trial Over: Stop. You can relax.</p>	<p>Trial Over: Deténgase. Puede descansar.</p>
<p>Repeat Condition 1: Can we try that again?</p>	<p>Repeat Condition 1: ¿Podemos intentarlo otra vez?</p>
<p>Start Condition 2: This time we'll do the same thing, but with your eyes closed. Ready? Cross your arms. Put your feet together. When you close your eyes, we'll start. (Press the USB button to start timer.)</p>	<p>Start Condition 2: Esta vez volveremos a hacer lo mismo, pero deberá cerrar los ojos. ¿Listo(a)? Ponga los brazos cruzados sobre el pecho. Ponga los pies juntos. Cuando cierre los ojos, comenzaremos. (Press the USB button to start the timer.)</p>
<p>Trial Over: Open your eyes and relax.</p>	<p>Trial Over: Abra los ojos y descanse.</p>
<p>Repeat Condition 2: Can we try that again?</p>	<p>Repeat Condition 2: ¿Podemos intentarlo otra vez?</p>
<p>Start Condition 3: This time you'll be doing the same thing but standing on this foam and looking at the mark on the wall. Ready? Step up on the foam. Cross your arms. Put your feet together. Look at the mark. Begin. (Quickly press the USB button.)</p>	<p>Start of Condition 3: Esta vez volverá a hacer lo mismo, pero debe pararse sobre esta espuma y mirar la marca en la pared. ¿Listo(a)? Párese en la espuma. Ponga los brazos cruzados sobre el pecho. Ponga los pies juntos. Mire la marca. Comience. (Quickly press the USB button.)</p>
<p>Trial Over: Step down.</p>	<p>Trial Over: Se puede bajar.</p>
<p>Repeat Condition 3: Can we try that again?</p>	<p>Repeat Condition 3: ¿Podemos intentarlo otra vez?</p>

English scripts	Spanish scripts
<p>Start Condition 4: Next, you'll do the same thing but with your eyes closed. Ready? Step up on the foam. Cross your arms. Put your feet together. When you close your eyes, we'll start. (Press the USB button to start the timer.)</p>	<p>Start Condition 4: Ahora, volverá a hacer lo mismo, pero con los ojos cerrados. ¿Listo(a)? Párese en la espuma. Ponga los brazos cruzados sobre el pecho. Ponga los pies juntos. Cuando cierre los ojos, comenzaremos. (Press the USB button to start the timer.)</p>
<p>Trial Over: Open your eyes and step down.</p>	<p>Trial Over: Puede abrir los ojos y bajarse.</p>
<p>Repeat Condition 4: Can we try that again?</p>	<p>Repeat Condition 4: ¿Podemos intentarlo otra vez?</p>
<p>Start Condition 5: For the last test, you'll do the same thing, but this time you'll be moving your head from side-to-side to this beat. (Turn on metronome) Watch me. (Demonstrate) Ready? Step up on the foam. Cross your arms. Put your feet together. Close your eyes. When you start turning your head, we'll start. (Press the USB button to start timer.)</p>	<p>Start Condition 5: Para esta última prueba de equilibrio, tendrá que hacer lo mismo, pero esta vez debe girar la cabeza de lado a lado, siguiendo este ritmo. (Turn on metronome) Míreme. (Demonstrate) ¿Listo(a)? Párese en la espuma. Ponga los brazos cruzados sobre el pecho. Ponga los pies juntos. Cierre los ojos. Cuando comience a girar la cabeza, comenzaremos la prueba. (Press the USB button to start timer.)</p>
<p>Trial Over: Stop. Open your eyes and step down.</p>	<p>Trial Over: Deténgase. Puede abrir los ojos y bajarse.</p>
<p>Repeat Condition 5: Can we try that again?</p>	<p>Repeat Condition 5: ¿Podemos intentarlo otra vez?</p>
<p>MRT Test Complete: We're all done with the balance test. After I remove the belt, please have a seat while I finish recording these results. Thank you for your hard work!</p>	<p>MRT Test Complete: Hemos terminado la prueba de equilibrio. Después de que le quite la correa, puede sentarse mientras termino de registrar los resultados. Gracias por participar.</p>

Appendix B
Examples of Report of Findings

Appendix B

Examples of Report of Findings

A final Report of Findings will be provided to participants after the MEC exam.

Examples of the Final Report of Findings

Balance

You performed a Modified Romberg test for balance during your examination. This screening test is listed by the Centers for Medicare and Medicaid (CMS) Physician Quality Reporting System for fall risk assessment.

[For SPs who passed Conditions 1–5 of the MRT, this additional text will be included in the report:]

Based on the Modified Romberg screening test, you are not at risk for falling.

[For SPs who passed Conditions 1–4 of the MRT but not Condition 5, this additional text will be included in the report:]

Based on the Modified Romberg screening test, you passed. When testing your inner ear function with balance, you may be at risk for falling.

[For SPs who did not pass Conditions 1–4 of the MRT, this additional text will be included in the report:]

Based on this screening test, you may be at risk for falling. We highly recommend that you discuss this result with your doctor.