



NIH Toolbox

Reasonable Accommodation Guidelines

September, 2012

This project is funded in whole or in part with Federal funds from the Blueprint for Neuroscience Research and the Office of Behavioral and Social Sciences Research, National Institutes of Health, under Contract No. HHS-N-260-2006-00007-C and from the National Institute on Disability and Rehabilitation Research: Rehabilitation Research and Training Center on Improving Measurement of Medical Rehabilitation Outcomes (H133B090024)

Table of Contents

General Rule for providing accommodations to people with disabilities	1
Physical Environment	1
Enhancing Accessibility during the Testing Sessions	2
Social Emotional Environment	2
Understanding the reasonable accommodation guidelines	3
Cognition Domain Battery	4
NIH Toolbox Picture Vocabulary Test	5
NIH Toolbox Flanker Inhibitory Control and Attention Test	7
NIH Toolbox List Sorting Working Memory Test	9
NIH Toolbox Dimensional Change Card Sort Test	12
NIH Toolbox Pattern Comparison Processing Speed Test	13
NIH Toolbox Picture Sequence Memory Test	15
NIH Toolbox Oral Reading Recognition Test	17
Emotion Domain Battery	19
Sensation Domain Battery	21
NIH Toolbox Odor Identification Test	22
NIH Toolbox Dynamic Visual Acuity Test	23
NIH Toolbox Visual Acuity Test	23
NIH Toolbox Hearing Threshold Test	24
NIH Toolbox Regional Taste Intensity Test	26
Motor Battery	28
NIH Toolbox 9-Hole Pegboard Dexterity Test	29
NIH Toolbox Grip Strength Test	31
NIH Toolbox Standing Balance Test	32
NIH Toolbox 4-Meter Walk Gait Speed Test	34
NIH Toolbox 2-Minute Walk Endurance Test	36

This project is funded in whole or in part with Federal funds from the Blueprint for Neuroscience Research and the Office of Behavioral and Social Sciences Research, National Institutes of Health, under Contract No. HHS-N-260-2006-00007-C and from the National Institute on Disability and Rehabilitation Research: Rehabilitation Research and Training Center on Improving Measurement of Medical Rehabilitation Outcomes (H133B090024)

General Rule for Providing Accommodations to People with Disabilities

When testing individuals with disabilities do not assume that a specific accommodation will work for him or her. Rather,

1. Describe task demands of the measure and ask whether she or he can complete the measure in the ways required in a standard administration.
2. If the Toolbox participant indicates that s/he cannot complete a measure using standard procedures, discuss relevant accommodations with him or her and determine whether these accommodations would allow him or her to complete the measure.
3. In some circumstances it may make sense to provide some additional practice using the accommodated approach.
4. In all circumstances, ensure that the participant understands that she or he is under no obligation to complete a measure that they are uncomfortable completing. In testing circumstances, participants may push themselves hard and attempt to please the test administrator.

Physical Environment

People with disabilities are experts on their needs. Successful accommodations can be facilitated by working collaboratively with the individual.

Creating a Physically Accessible Testing Environment

1. The NIH Toolbox should be administered in a barrier-free environment. This should include:
 - i. Proximity to accessible transportation.
 - ii. Physical accessibility of the building to allow the person with a disability to enter and move about the testing area (including accessible bathroom facilities).
 - iii. Communication access to ensure that the person has access to instructions and informed consent in a way that they can use and understand. Communication access may include:
 - a. Written formats or sign language formats for people who are deaf or hard of hearing.
 - b. Audio, large print or Braille formats for people who are blind or have low vision.
 - c. Simplified, easy to understand versions for people with cognitive impairments.
2. Testing should be conducted in a **quiet well lit room with minimal distractions**. Florescent lighting can cause headaches among some people with disabilities. To enhance access for people with chemical sensitivities, test administrators should **minimize the use of scented products** (e.g., personal care items like lotions and perfumes).

3. The length of testing sessions should be increased to allow sufficient time for administration of accommodated measures, rest breaks, and bathroom breaks as appropriate.
4. The testing table should allow a wheelchair user to comfortably approach and access the testing set up. Features of the wheelchair such as motorized controls on the armrests may prevent some users from approaching the testing table. The use of a height adjustable table can be helpful. An adjustable “hospital tray table” is a low cost portable and readily available alternative.

Enhancing Accessibility during the Testing Sessions

1. Consider **screening for vision, hearing, reading and hand function** as these may identify people who need reasonable accommodations.
2. Presence of secondary conditions and some impairment effects can affect performance. Delineate task demands in advance to the participant and seek their input about how to best accommodate their needs (e.g. can the person operate the mouse or would they prefer to direct the administrator to enter responses for them?).
3. If participant has decreased hand function **allow time to “play” with buttons** so they can figure out most efficient methods to press keys accurately and quickly in a non-testing situation. People with spinal cord injuries tend to use more shoulder abduction and internal rotation which can lead to fatigue effects during cognition testing.
4. Have **alternate input devices** available for people with decreased hand function, e.g. track ball, track pad, large keyboard.
5. **Pay attention to ergonomics** as fatigue effects and poor body posture can have a greater impact on people with disabilities. Ensure monitor is at eye level, minimize glare, and allow enough space under the table for chair and legs. Consider the use of forearm supports to reduce fatigue and discomfort during testing and the need to maintain position for prolonged periods.

Social Emotional Environment

1. Create a calm, supportive, non-hurried testing environment. Many of these measures can be threatening to people with disabilities as they are designed to pinpoint deficits.
2. Explain basic testing principles (e.g., the aim of targeting deficits/limitations, the principles of computerized adaptive testing) to help allay fears, testing anxiety and feelings of discouragement over performance. This is especially important with cognition measures.

3. Attend to participants verbal and non-verbal cues for signs of frustration, fatigue, discomfort. Breaks and reassurances can be provided as appropriate between measures.
4. Allow sufficient opportunities for breaks and late arrivals – issues like pressure relief, bathroom breaks, and unreliable disability transportation can influence the testing session.
5. Long testing batteries such as the NIH Toolbox can create pressure on the administrator to “push through” and complete the battery but doing so may have a negative impact on performance. Rapid pacing can exacerbate negative emotional responses and mental fatigue thereby compromising performance. Allow adequate time so you don’t feel rushed.

UNDERSTANDING THE REASONABLE ACCOMMODATION GUIDELINES

Every measure in the NIH Toolbox is designed to measure a specific aspect of neurological functioning; we call this the core construct. However, when measures are developed and made real in both computer-administered and non-computer administered formats additional task demands are imposed by the ways tasks are presented and responses entered or performance demonstrated. Secondary task demands related to presentation formats and response entry can make the measures inaccessible to some users. Depending on the nature of individual impairments, some users may be able to access an assessment but not in the way that the developers intended, the validity of measures may be compromised by these types of non-standard administrations. A measure is inaccessible when an individual cannot complete it because they are unable to perform secondary task demands required by the measure. In order to determine if an accommodation results in a non-standard administration it is important for test administrators to understand both the core construct and the secondary task demands.

For each measure we provide:

- A brief description of the measure and what core construct it seeks to measure.
- A detailed analysis of the task demand, the core construct is highlighted in blue and starred.
- Accessibility issues and accommodations are presented for each measure. This section is broken down to highlight the feature that poses a barrier, the problem for a specific group of users, and a potential solution including whether to consider the accommodation a standard or non-standard administration.

COGNITION BATTERY

The cognition domain battery consists of 7 computer administered measures of cognitive function to measure:

- Language (picture vocabulary and reading decoding)
- Memory (working and episodic)
- Processing Speed
- Attention
- Executive Function (inhibitory control and cognitive flexibility)

Table 1: Accessibility of Cognition Measures

Measure	Blind	Low Vision	Decreased Hand Function	Mobility Impairment	Deaf	Hard of Hearing	Speech impairment	Reading Impairment
Picture Vocabulary	N	P	P	A	P	P	A	A
Flanker Inhibitory Control and Attention	N	P	P	A	P	A	A	A
List Sorting Working Memory	N	P	A	A	A	A	N	A
Dimensional Change Card Sort	N	P	P	A	A	A	A	P
Pattern Comparison Processing Speed	N	P	P	A	P	A	A	A
Picture Sequence Memory	N	P	P	A	P	A	A	A
Oral Reading Recognition	N	P	A	A	P	A	N	A

N= not accessible and not feasible to make accessible

P=Not accessible, but can be made accessible with reasonable accommodations

A= Currently accessible

NIH TOOLBOX PICTURE VOCABULARY TEST

Description: This computer adaptive test measures receptive vocabulary.

Task Demands

- **AUDITORY:** High. Participant must be able to hear words presented orally by a recorded voice.
- **VISUAL:** High. Participant must be able to see and differentiate 4 photographic images of varying complexity.
- **COGNITIVE:** High. Participant must be able to understand the word or concept and have sufficient abstraction to associate the word with the photographic image. Association between the word and the images may be literal or more abstract. As complexity of the words increases level of abstraction also increases.
- **MOTOR:** Moderate. Participant must be able to use a mouse or alternate input device to target an image on screen (size approximately, 2" x 3")

Accessibility issues and accommodations

1. **Feature:** Oral presentation of words
Problem: May disadvantage some people with hearing impairments. This may reasonably be expected to increase with age related hearing loss. May compromise validity by conflating hearing with vocabulary comprehension.
Solution: Administrator may repeat the word, upon participant request to ensure that the word is heard accurately.
**Document as non-standard administration, specify which words were read for the participant. Consistent need to repeat certain words may be indicative of need to re-record certain words.
2. **Feature:** Oral presentation of words
Problem: The measure is inaccessible to people who are deaf.
Solution: Provide administrator with cards with words on them. If the participant and administrator know sign language, administrator may finger spell the word for the participant.
Given the expressive nature of American Sign Language (ASL) it is not recommended that participants be given signs for the words as these may provide cues as to their meaning.
**Document as non-standard administration.

3. Feature: Manual entry of response option.
Problem: May limit accessibility of measure to people with upper extremity and fine motor impairments. May also lead to frustration and fatigue which could impede overall performance and compliance.
Solution: Under the direction of the participant, administrator may enter participant responses.
**Consider as standard administration, does not alter core task demands. Document accommodation provided.

4. Feature: Response options presented as photographic images
Problem: The measure is inaccessible to people with low vision and blindness
Solution: **Omit measure and document reason for omission.

NIH TOOLBOX FLANKER INHIBITORY CONTROL AND ATTENTION TEST

Description: This fixed length computer administered test measures inhibitory control and visual attention.

Task Demands

- **Auditory:** Minimal, all instructions are presented on screen.
- **Visual:** High, Participant must be able to see with sufficient visual acuity to distinguish small arrow heads (and fish in the pediatric version) on the screen, 5 test stimuli are presented in close proximity to one another.
- **Cognitive: High, Participant must be able to attend to directionality of small arrow in the middle of a visual array of 5 arrows.**
Participant must make rapid decisions about the directionality of the middle arrow while ignoring the distracting stimuli.
Participant must be able to “translate” cognitive decision into a motor response to select the arrow key that corresponds with the fish direction.
Participant must be able to sustain attention to this timed test for approximately 5 minutes.
- **Motor:** Moderate, Participant must be able to use isolated index finger movement on their dominant/preferred hand to target the standard sized left and right arrow keys on the computer keyboard.
Participant should have sufficient proprioceptive sense in the index finger to ensure rapid and Accurate key pressing without visual Input.

Accessibility Issues and Accommodations

1. **Feature:** Arrows are small and close together
Problem: Decreased arrow size may disadvantage people with visual impairments.
May compromise validity by confounding visual acuity with inhibitory control and attention.
Solution: If noted in practice trials that size of the arrows limits performance, experiment with scale of the arrows by using the “ctrl +” to increase the size of the arrows.
**Document as non-standard administration as it may alter task demands by increasing ease of distinguishing between arrows. If scalability enhancement is used, indicate magnification used by indicating number of times the magnification was increased.
2. **Feature:** Response must be entered by the participant using the index finger of the dominant hand.

Problem: May compromise validity by conflating speed of motor response with executive function-cognitive flexibility. Scoring is based on both speed and accuracy of response. This is especially problematic for people with spinal cord injuries with reduced upper extremity function who are able to complete the task but require more shoulder abduction and internal rotation.

Solution: Allow participant to use alternative finger.
**Document as non-standard administration for any participant who completes the test using movements other than isolated index finger movement. Describe the nature of the participant's movement pattern to the best of your ability.

3. Feature: Response must be entered using the index finger of the dominant hand

Problem: Participant does not have use of index finger of dominant hand (e.g. to paralysis (complete or partial) or limb loss.

Solution: Use index finger on preferred hand.
**Document as standard administration.

NIH TOOLBOX LIST SORTING WORKING MEMORY TEST

Description: This variable length computer administered measures assesses working memory.

Task Demands

- **Auditory:** Moderate. Instructions are presented orally. As test stimuli (pictures of animals or foods) are presented on screen the computer identifies the object.
- **Visual:** High. Participants must be able to see the objects and their relative size. Participants are instructed to “pay attention to the size of the objects on the screen and not rely on their previous experience.”
- **Speech:** Moderate. Participants must be able to say the objects loudly and clearly enough for the administrator to score their response.
- **Cognitive: High. Participant must be able to remember the objects presented and sequence them from smallest to largest, first in a single condition and then in 2 condition. Participant must be able to inhibit responses from previous trial and repeat only new set of items.**
- **Motor:** None. This test is motor-free

Accessibly issues and accommodations

1. **Feature:** Oral presentation of instructions
Problem: People who are deaf or hearing impaired may not be able to understand all of the instructions.
Solution: If participant is deaf and know American Sign Language (ASL), provide instructions using ASL.

OR

Provide participant with written instructions, ensure that the participant understands the task demands and allow them to ask questions.

**Document as standard administration, does not alter core construct.

2. **Feature:** Redundancy in stimuli presentation (visual and oral)
Issue: Redundancy in stimulus presentation ensures that users with visual and hearing impairments can take this measure.
However, reliance on a vision or hearing alone may limit comparability to norms as the participant has to rely on either visual or verbal memory.
Solution: Administer measure.

**Document as non-standard administration and indicate the nature of the person's impairments.

3. Feature: Responses must be stated verbally.

Problem: May disadvantage users who are non-verbal, e.g. have aphasia or dysarthria.

Solution: If the participant and administrator know ASL allow the participant to state answers in ASL.

**Document as non-standard administration and indicate how response was provided.

Note: People who are fluent in ASL may be able to provide their responses as quickly and as efficiently as verbal responses among the hearing population.

OR

If the participant uses a communication device, allow them to enter their response using their device.

**Document as non-standard administration and indicate how response was provided.

Note: The cognitive and motor demands of using alternate and augmentative communication devices may interact with working memory and lower scores.

NIH TOOLBOX DIMENSIONAL CHANGE CARD SORT TEST

Description: This fixed length computer administered measure assesses cognitive flexibility and attention.

Task Demands

- **Auditory:** Minimal, Instructions are presented orally and written on the screen.
- **Visual:** High. Participants must be able to see the objects on the screen.
Participant must be able to read cue word
Participant must be able to distinguish between light yellow and dark blue.
- **Verbal:** None
- **Cognitive: High. Participant must be able to remember the objects presented and sequence them from smallest to largest, first in a single condition and then in 2 condition. Participant must be able to inhibit responses from previous trial and repeat only new set of items.**
- **Motor:** Moderate. Participant must be able to use isolated index finger movement on their dominant/preferred hand to target the standard sized left and right arrow keys on the computer keyboard.
Participant should have sufficient proprioceptive sense in the index finger to ensure rapid and accurate key pressing without visual input.

Accessibility Issues and Accommodations

1. **Feature:** Cue word is presented in written form only
Problem: People with low vision and reading disabilities may be unable to read the cue word.
May compromise validity by conflating reading ability with cognitive flexibility.
Solution: Administrator may read the cue word for participants with low visual or reading impairments.
**Document as non-standard administration as the oral presentation of the cue words may alter the task demands for sustained attention. Indicate accommodation provided and the reason for it.
2. **Feature:** Test stimuli are presented in visual format only.
Problem: The measure is inaccessible to people who are blind.
Solution: Omit this measure for people who are blind

3. Feature: Response must be entered using index finger of the dominant hand.
- Problem: May compromise validity by conflating speed of motor response with executive function-cognitive flexibility. Scoring is based on both speed and accuracy of response. This is especially problematic for people with spinal cord injuries with reduced upper extremity function who are able to complete the task but require more shoulder abduction and internal rotation.
- Solution: Allow participant to use alternative finger.
**Any participant who completes the test using movements other than isolated index finger movement should be documented as non-standard administration, please describe the nature of the participants movement pattern to the best of your ability.

NIH TOOLBOX PATTERN COMPARISON PROCESSING SPEED TEST

Description: This fixed length computer administered measure assesses processing speed.

Task Demands

- **Auditory:** Moderate. All instructions are presented orally by the test administrator.
- **Visual:** High. Participant must be able to see with sufficient visual acuity to distinguish between 2 graphical images (approximate size 3" X 3¼") Participant must be able to distinguish color difference between similar images.
- **Cognitive:** High. Participant must make rapid decisions about the similarity or difference between two images.
Participant must be able to "translate" cognitive decision into a motor response to select the arrow key that corresponds to Yes and No (smiley/frowny face in children under the age of x).
Participant must be able to sustain attention to this timed test for approximately 90 seconds.
- **Motor:** Moderate. Participant must be able to use isolated index finger movement on their dominant/preferred hand to target the standard sized left and right arrow keys on the computer keyboard.
Participant should have sufficient proprioceptive sense in the index finger to ensure rapid and accurate key pressing without visual input.

Accessibility issues and accommodations

1. **Feature:** Test stimuli are presented in visual format only.
Problem: The measure is inaccessible to people who are blind.
Solution: Omit this measure for people who are blind

2. **Feature:** Oral presentation of instructions
Problem: People who are deaf or hearing impaired may not be able to understand all of the instructions.
Solution: If participant is deaf and know American Sign Language (ASL), provide instructions using ASL.

OR

Provide participant with written instructions, ensure that the participant understands the task demands and allow them to ask questions.

3. Feature: Response must be entered using index finger of dominant hand.
- Problem: May compromise validity by conflating speed of motor response with executive function-cognitive flexibility. Scoring is based on both speed and accuracy of response. This is especially problematic for people with spinal cord injuries with reduced upper extremity function who are able to complete the task but require more shoulder abduction and internal rotation.
- Solution: Allow participant to use alternative finger.
- **Any participant who completes the test using movements other than isolated index finger movement should be documented as non-standard administration, please describe the nature of the participants movement pattern to the best of your ability.

NIH TOOLBOX PICTURE SEQUENCE MEMORY TEST

Description: This computer administered measure assesses visual episodic memory.

Task Demands

- **Auditory:** High. All instructions are presented orally by the test administrator. Brief verbal descriptions are provided for each stimulus
- **Visual:** High. Participant must be able to see with sufficient visual acuity see graphical images (approximate size 1" X 1¼")
Participants must be able to recognize the distinguishing features of each image in order to sort them into the proper order.
The images enlarge to 1 3/8" X 1 ¾" when clicked
- **Cognitive:** Participant must sustain their attention to the computer as an array of 4-18 pictures on a related theme are placed in sequence (note the sequence does not follow any logical order so participants may not rely on previous experience)
After a brief study period, participants must correctly sequence the pictures.
Participant must complete 3-trials of the task, regardless of accuracy of performance.
Depending on the participants age and accuracy of performance, participant may be asked to complete additional trials (automated feature not under administrators control)
- **Motor:** Participant must be able to use the mouse to click on the picture and then click on the target (both 1" X 1 ¼").
- **Emotional:** this is a demanding task and some participants express frustration over poor performance.
- Multiple repetitions of same test are interpreted by some participants as a sign of poor performance.

Accessibility Issues and Accommodations

1. **Feature:** Images are relatively small (1" x 1 ¼")
Problem: May disadvantage people with visual impairments. May challenge validity by conflating visual acuity with episodic memory.
Solution: Pictures should be scalable. Increasing zoom to 130% increases size of image to 1 ¼" x 1 ½" while still allowing all of the testing stimuli to be presented on screen. Furthermore when image is "clicked on it expands to 1 ¾" x 2 ¼" compared to 1 3/8" x 1 ¾").
Administrator will need to resize after completion of the test so that they can access all buttons on the administrator screen.
**Does not alter task demands – consider as standard administration but document accommodation.

2. Feature: Participant must have sufficient visual acuity to see and identify the images and the target boxes.

Problem: Test is inaccessible to people who are blind or with severe visual impairments

Solution: Omit measure for people who are blind

3. Feature: Mouse activation of the PSM

Problem: People with decrease hand function (such as those with tetraplegia) are unable to activate mouse.

Solution: Make alternate input device such as a trackball or track pad available (recommend inclusion of these devices as part of Toolbox equipment list).

**Does not alter core task demands, document as standard administration.

OR

Participant can instruct administrator on proper position of each item.

** Document as non-standard administration as the need to direct administrator may increase the cognitive task demands in this memory test.

NIH TOOLBOX ORAL READING RECOGNITION TEST

Description: Computer adaptive measure of reading decoding.

Task Demands

- **Auditory:** Minimal. All instructions are presented orally by the test administrator.
- **Visual:** High. Participant must be able to see with sufficient visual acuity to read large black letters on a white screen.
- **Speech:** High Participants must be able to speak with sufficient clarity for the test administrator to hear and understand their pronunciation/enunciation of the words. Mispronunciations are scored as incorrect.
- **Cognitive: High. Participant must be able to accurately read the words aloud. Words are largely phonetic therefore people with good phonemic skills can sound out words. Understanding of the meaning of the words is not required.**
- **Motor:** Minimal. Oral motor only, described above under Speech.
- **Emotional:** the computer adaptive nature and the scoring by administrator makes this test challenging.

Accessibility Issues and Accommodations

1. **Feature:** Words presented in standard font size – relatively large
Problem: May disadvantage some people with visual impairments
Solution: Words are scalable, increase screen magnification/ must be careful to ensure that longer words still fit on the screen.
2. **Feature:** Words must be expressed orally
Problem: Disadvantages people with aphasia who may be able to read the word but lack the ability to express it verbally.
Solution: Even people with speech impairments ought to be tested as many might have strategies to help them decode and express single words. Document presence of speech impairment in case scores are impacted.
3. **Feature:** Words must be expressed orally
Problem: May disadvantage people with expressive language impairments (e.g. dysarthria due to oral motor impairments or limited verbal communication e.g. some people who are deaf.) May compromise accuracy of scoring as administrators are challenged to determine if mispronunciations are due to reading or oral motor impairments
Solution: Administer test according to standardized administration protocol. Document as non-standard administration.

People with strong regional accents may be similarly disadvantaged by this measure and this should be documented.

- 4. Feature: Computer Adaptive Test
- Problem: May lead to anxiety over poor or lost reading abilities.
- Solution: Validate participant's feeling. Explain the nature of computer adaptive testing and the goal to push people to their limits.

THE EMOTION BATTERY

The emotional health domain consists of computer administered and computer adaptive patient-reported measures across 4 subdomains, including:

- Psychological Well-Being (life satisfaction & meaning, positive feeling states)
- Negative Affect (sadness, fear, anger)
- Stress and Self-Efficacy (self-efficacy, perceived stress)
- Social relationships (social support, companionship, social distress)

Table 2: Accessibility of Emotional Health Measures

Measure	Blind	Low Vision	Decreased Hand Function	Mobility Impairment	Deaf	Hard of Hearing	Speech Impairment	Reading
All measures	P	P	P	A	A	A	A	P

N=not accessible and not feasible to make accessible

P=Not accessible, but can be made accessible with reasonable accommodations

A=Currently accessible

Task Demands

- **Auditory:** None. All instructions are provided on screen.
- **Visual:** High. Participant must be able to see with sufficient visual acuity to read words.
- **Reading:** High. Participant must be able to read and understand instructions, self-report questions, and response options.
- **Speech:** None.
- **Cognitive: Moderate.** Participant must be able to attend to task of reading items on screen for 20-30 minutes.
- **Participant must be able to understand the meaning of the questions, reflect on personal experience and select the appropriate response.**
- **Motor:** Moderate. Participant must use the mouse to select the appropriate response option.

- **Emotional: Moderate. The nature of the items asks the participants to reflect on their previous life experiences which may be positive or negative.**

Accessibility Issues and Accommodations

- Feature:** All items are presented in written format only

Problem: Inaccessible to people with visual and/or reading impairments. Given the highly stigmatized nature of reading impairments many people may be reluctant to ask for the reasonable accommodation of having administration read items to them. Furthermore use of a reader may lead to mode effects based on social desirability given the sensitive content of emotional health items.

Solution: Measure to be made screen reader compatible.

OR

Read items and ask participant to enter own response.

**Document as non-standard administration due to concern about mode effect

OR

Administrator reads items and enters participant's responses.

**Document as non-standard administration due to concern about mode effect
- Feature:** Participants must enter response using a standard mouse.

Problem: Some users with upper extremity impairments may be unable to use a mouse.

Solution: Substitute an appropriate alternate input, such as a track ball or track pad.

**Does not alter task demands. Consider as standard administration

OR

Show the participant how to activate keyboard equivalents. ALT+1,2,3,4

**Does not alter task demands. Consider as standard administration.

OR

Enter response for them.

**Document as non-standard administration due to potential impact on response due to social desirability of response options.
- Feature:** Target size of the radio buttons very small for one set of items with a horizontal display.

Problem: Small target may be very difficult for people with poor fine motor and upper extremity control

Solution: Activate key board equivalents. (ALT+1,2,...)

**Does not alter task demands. Consider as standard administration.

OR

Enter response for them.

**Document as non-standard administration due to potential impact on response due to social desirability of response options.

4. Feature: Participant may note that emotion items may be interpreted in terms of condition (muscles twitched=spasticity)

Problem: May compromise validity by conflating condition symptoms with emotional experiences.

Solution: **Document as non-standard administration of perceived stress item bank and indicate the nature of the impairments to the best of your abilities.

THE SENSATION BATTERY

The sensory domain consists of 5 measures that assess

- Olfaction
- Vision (static)
- Vestibular Function
- Hearing
- Taste

Table 3: Accessibility of Sensory Measures

Measure	Blind	Low Vision	Decreased Hand Function	Mobility Impairment	Deaf	Hard of Hearing	Speech Impairment.	Reading
Odor Identification	P	P	P	A	P	P	A	A
Static Visual Acuity	NA	A	A	A	P	A	A	A
Dynamic Visual Acuity	NA	A	A	P-N	P	A	A	A
Hearing Thresholds	P	P	P	A	NA	P	A	A
Toolbox Taste Test	P-N	P	P	A	P	A	A	A

N=not accessible and not feasible to make accessible

P=Not accessible, but can be made accessible with reasonable accommodations

P-N= Accessibility depends on participant's ability

A=Currently accessible

NA=Not applicable

NIH TOOLBOX ODOR IDENTIFICATION TEST

Description: This 10-item odor identification tests uses scratch and sniff cards with computer entry of responses.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally.
- **Visual:** High. Participant must be able to see and differentiate the four response options.
- **Olfactory: High. Participant must be able to smell and distinguish common odors.**
- **Cognitive:** Minimal. Participant must understand the concept of matching scent to picture. Protocol in children includes an assessment of familiarity of the response options.
- **Motor:** Moderate. Participant must be able to scratch the scratch and sniff card and bring it to their nose.
Participant must use the mouse to click on the picture that best matches the scent (2" X 3")
- **Emotional:** Minimal

Accessibility issues and accommodations

1. **Feature:** Requires adequate motor function to scratch card and hold to nose.
Problem: Participants with decreased hand function may be unable to independently complete the task.
Solution: Administrator can scratch and hold the card for the participant.
**Does not change test parameters – consider as standard administration.
2. **Feature:** Response options presented visually in the form of pictures.
Problem: Inaccessible to people who are blind
Solution: Administrator reads response options and click on the participant's selection.
**Does not change key test parameters – consider as standard administration.
3. **Feature:** Scratch and sniff cards use synthetic sense strips.
Problem: Synthetic strips may be problematic for participants with multiple chemical sensitivities.
Solution: Omit measure with people with multiple chemical sensitivities.
**Indicate reason for exclusion in end of test forms.

NIH TOOLBOX DYNAMIC VISUAL ACUITY TEST AND NIH TOOLBOX VISUAL ACUITY TEST

Description: These computer adapted tests measures static and dynamic visual acuity.

Task Demands

- **Auditory:** Moderate. All instructions are provided verbally with demonstration.
- **Visual: High. This is a measure of static visual acuity and dynamic eye gaze stabilization.**
- **Reading:** Moderate. Must be able to name letters that appear on screen. Children under 8 are provided a laminated card that they can point to match the letter.
- **Speech:** Moderate. Must be able to articulate letters that appear on the screen.
- **Vestibular:** High. Must have sufficient eye gaze stabilization to be able to read letters that flash on the screen.
- **Touch:** None
- **Cognitive:** Minimal. Participant must be able to understand the instructions and concept of gaze stabilization.
- Participant must be able to recognize letters and accurately name letters.
- **Motor:** Moderate. For the dynamic portion of the test, participant must have sufficient motor control to turn head side to side at required rate and amplitude.
- **Emotional:** Minimal

Accessibility issues and accommodations

1. **Feature:** Participants 8 and older must name the letter that they see on the screen.
Problem: People who are non-verbal may be able to see but not name the letter.
Threat to validity by conflating verbal and visual acuity and eye gaze stabilization.
Solution: As in the pediatric version, provide people with a laminated response card so that they may point to the letter they saw on screen.

OR

Person may indicate their response using an alternate or augmentative form of communication, for example alphabet board, speech synthesizer, or ASL. Depending on the form of communication this may increase the test length and should be accommodated in scheduling.

** Document as standard administration does not alter core task demands but indicate accommodations in the end of test form.

2. **Feature:** Participants 8 and older must name the letter that they see on the screen.
Problem: People with reading impairments or decreased cognitive capacity may not be able to name the letter.

Threat to validity by conflating reading ability with visual acuity and eye gaze stabilization.

Solution: As in the pediatric version, provide people with a laminated response card so that they may point to the letter they saw on screen.

** Document as standard administration does not alter core task demands but indicate accommodations.

3. Feature: Participants must be able to rotate head side to side at a specified rate and amplitude.

Problem: Participants with decreased neck movement and range of motion may be unable to achieve the required head turning.

Solution: Omit measure.

**Document reason for omitting measure, describe the person's physical impairments to the best of your abilities.

4. Feature: Participants must be able to rotate head side to side at a specified rate and amplitude.

Problem: Participants with decreased motor planning may be unable to achieve the required rate and amplitude of movement.

Solution: Provide additional training and demonstration as appropriate, including demonstration, additional instruction and manual demonstration.

OR

Confirm that there are no issues with the cervical spine, e.g. spinal instability, pain, etc. If a second administrator is available manually guide the participant through the range of movements.

**While these techniques do not interfere with the core task demands they are significant and should be documented.

5. Feature: Requires rapid head turning side to side while maintaining eye gaze on central spot.

Problem: Can lead to discomfort in neck

Solution: Monitor for signs of neck pain. Ensure that the participant rests between trials.

6. Feature: Participants are often unclear of what the measure is testing and assume it is related to the more familiar concept of peripheral vision

Problem: Participants may perform poorly because of confusion over the construct being measured. Failure to maintain focus on the screen can also lead to more feelings of dizziness and nausea.

Solution: Clarify instruction to ensure that participants understand the task demands to the highest degree possible.

**Document as standard administration, does not alter core task demands.

NIH TOOLBOX HEARING THRESHOLD TEST

Description: This computer administered test measures auditory sensitivity.

Task Demands

- **Auditory: High.** This is a measure of auditory sensitivity
- **Visual:** Moderate. If the participant is using a mouse, they must be able to see the response options in order to select them.
- **Reading:** Minimal.
- **Speech:** Minimal.
- **Vestibular:** N/A
- **Touch:** N/A
- **Cognitive:** Minimal. Participant must be able to understand the instructions and selecting a response option.
- **Motor:** Moderate. Participant must have sufficient motor control to operate a mouse or depress an arrow key.
- **Emotional:** Minimal

Accessibility issues and accommodations

1. **Feature:** Participant is required to enter response using either a mouse or the arrow keys on the keyboard.
Problem: People with decreased hand function may not be able to use the mouse or arrow keys.
Solution: Participant can direct the administrator to enter their responses for them.
2. **Feature:** Participant must be able to see the response options on the screen in order to enter responses with a mouse.
Problem: People with visual impairments and blindness may not be able to see the response target.
Solution: Participant can use the arrow keys to enter responses.

OR

Participant can direct the administrator to enter the response for them.
3. **Feature:** Participant is prompted at the end of the trial with “Did you hear the beep?” written in text indicating that a response is required.
Problem: Participants with visual impairments and blindness may not know that a response is required after a negative trial (i.e. one where no beep is played).

Solution: The administrator may provide tactile cuing when a response is required. The acceptability of this accommodation should be explored with the participant.

NIH TOOLBOX REGIONAL TASTE INTENSITY TEST

Description: This 4-condition taste test uses tasting solutions and computer entry of responses to measure sensitivity to bitter and salty tastes.

Task Demands

- **Auditory:** Moderate. Instructions on use of the non-interval scale are provided verbally and printed on screen. Instructions for the tasting portion of the assessment are only provided verbally.
- **Visual:** High. Participant must be able to see the non-interval scale in order to accurately position answers.
- **Reading:** Minimal. All written instructions are repeated verbally.
- **Taste: High. Participant must be able to distinguish various types of tastes and their intensities.**
- **Cognitive:** Minimal. Participant must understand the concept, including the use of the non-interval scale.
Participant must have sufficient impulse control not to swallow taste solution or spit out potentially unpleasant taste solutions before the 3-second trial elapses.
- **Motor:** Moderate. Participant must have sufficient oral motor control to stick out and hold out tongue during trials.
Participant must have sufficient motor control to sip from a cup, swish the solution in their mouth and spit into a spittoon.
Participant must use the mouse and/or arrow keys to enter indicate intensity on the scale.
- **Emotional:** Minimal. Participant must have some tolerance for unpleasant stimuli.

Accessibility issues and accommodations

1. **Feature:** Motor input required to use the response scale.
Problem: May be inaccessible to people with impaired upper extremity function
Solution: Test administrator can enter response under the participant's guidance.
2. **Feature:** Participant is asked to drink several solutions and spit in a bucket.
Problem: May be inaccessible to people with decreased shoulder, neck and upper extremity function and range of motion.
Solution: Administrator may bring solutions to participant's mouth and help the participant sip.
Administrator may also bring the spittoon to the participant's mouth.

3. Feature: Intensity rating scale is non-linear vertical scale ranging from no sensation to strongest sensation imaginable.
- Problem: Given non-linear nature of the scale, vision is required to understand spacing and positioning of intensity ratings. Measure may be inaccessible to people who are blind.
- Solution: During the training phase
Provide verbal description of the scale. Orient the participant to the scale by providing verbal description supplemented with hand over hand guidance to help the person trace the intervals and understand the spacing. This is a cognitively demanding task and may require multiple repetitions.
- During the trial
Provide slow hand over hand guidance across the scale. Name the anchor points (barely detectable, weak, moderate, strong, very strong, strongest sensation of any kind) out loud as the participant's finger passes over them.
- Once the participant determines the appropriate position on the scale, administrator should enter their response.
- **Document as non-standard administration. Impact on accuracy of reporting is unknown.
4. Feature: Participant is required to swish a thin liquid in their mouth for 3 seconds.
- Problem: People with dysphagia may inadvertently swallow the solution and create a risk of choking or aspiration.
- Solution: This is very unlikely in general population samples but discuss the task demands with the participant and their proxy, if appropriate, to determine if there are choking risks.
- **Omit the measure if there are known swallowing problems. Document reason for omission.

THE MOTOR BATTERY

The Toolbox Motor Battery consists of 5 performance based measures of motor function, including:

- Manual Dexterity
- Muscle Strength
- Static Standing Balance
- Gait Speed
- Endurance

Table 4: Accessibility of Motor Domain Measures

Measure	Blind	Low Vision	Decreased Hand Function	Mobility Impairment	Deaf	Hard of Hearing	Speech Impairment.	Reading
9-Hole Pegboard Dexterity	P	A	A	A	P	A	A	A
Grip Strength	A	A	A	A	P	A	A	A
Standing Balance	N	A	A	N	P	A	A	A
4 Meter Walk Gait Speed	P	A	A	P-N	P	A	A	A
2-Minute Walk Endurance	P	A	A	P-N	P	A	A	A

N=Not accessible and not feasible to make accessible

P=Not accessible, but may be made accessible with reasonable accommodations

P-N=Accessibility depends on the extent of mobility impairment

A=Currently accessible

NIH TOOLBOX 9-HOLE PEGBOARD DEXTERITY TEST

Description: This timed performance-based pegboard test measures manual dexterity in each hand.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally with demonstration.
- **Visual:** High. Participant must be able to see the holes in the pegboard to accurately and efficiently place the pegs.
- **Cognitive:** Minimal. Participant must understand the task demands which are relatively simple. Demonstration and practice are provided to ensure comprehension.
- **Motor:** High. Participant must be able to sit at the table and use each hand independently to pick up and place small plastic pegs in to a plastic pegboard.
- **Emotional:** Minimal. Participant may have some emotional responses to poor performance, e.g., frustration or discouragement.

Accessibility issues and accommodations

1. **Feature:** Participant must be able to see the holes in the pegboard to efficiently place pegs.
Problem: People who are blind or visually impaired may have greater difficulty seeing the holes. Risk conflating visual acuity and visual processing with hand function.
Solution: Document low vision.

OR

If the person is blind, allow them to find hole with the non-testing hand. Peg should be placed with the testing hand only and not assisted with the guiding hand.

**Document as non-standard administration. Task demands are altered as participant must rely on proprioceptive rather than visual input to identify target.

2. **Feature:** Instructions are provided verbally with demonstration.
Problem: May be inaccessible to people who are deaf or hard of hearing.
Solution: Provide instructions in alternate accessible format, such as ASL or written text.
**Does not alter task demands, mark as standard administration but accommodation should still be documented.

3. Feature: Test protocol requires testing of each hand.
- Problem: Participants with hemiplegia or motor paralysis in the arms and hands may be unable to complete 1 or both of the trials.
- Solution: Omit trials for hands with no pinch. Test should be administered to all other participants. If the participant is needs more than 60 seconds to complete a trial, the trial should be terminated.
- **Document reason for omission.

NIH TOOLBOX GRIP STRENGTH TEST

Description: This performance-based measure assesses grip strength in each hand. Proper body mechanics and positioning is important to ensure reliability.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally with demonstration.
- **Visual:** Minimal
- **Reading:** None.
- **Speech:** None.
- **Cognitive:** Minimal. Participant must understand the task demands which are relatively simple. Demonstration and practice are provided to ensure comprehension.
- **Motor: High. Participant must be able to get hand around the dynamometer and squeeze it.**
- **Participant must able to sit with their hips and knee at 90° with their arm at their side and elbow bent to 90°.**
- **Emotional:** Minimal. Participant may have some emotional responses to poor performance.

Accessibility issues and accommodations

4. **Feature:** Participant must be able to get hand around the dynamometer.
Problem: Some participants with decreased range of motion in their hands may be unable to get their hands around the dynamometer or squeeze it.
Solution: Have a conversation with the participant to determine if this measure is appropriate given their functional and physical abilities. If the person decides to attempt the test, the administrator should guide and facilitate hand placement around the dynamometer.
**Document level and type of assistance in set up and task performance.
5. **Feature:** Participant is asked to maintain a body posture with hips and knees at 90°, elbow bent to 90° and arm tucked in at the side.
Problem: Some participants may not be able to maintain this body positioning due to a variety of physical impairment issues, including motor paralysis, motor control, spasticity, decreased range of motion and contracture. This may change the mechanical advantage of the test.
Solution: The administrator should help the participant get in as close to optimal positioning as possible. If the prescribed testing position is not possible proceed with test but mark as non-standard in end of test forms.

If the participant is unable to maintain the proper positioning during exertion, administrator_should provide physical support to maintain proper alignment.
**Document as non-standard administration.

NIH TOOLBOX STANDING BALANCE TEST

Description: This 6-condition performance based measures postural sway to assess static bipedal standing balance.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally with demonstration.
- **Visual:** Moderate. Vision is an important stabilizer for balance and 3 of the postures are compared according the condition eyes open/eyes closed.
- **Reading:** None.
- **Speech:** None.
- **Cognitive:** Minimal. Participant must understand the concept the task demands.
- **Motor: High. Participants are screened for the ability to stand without assistive devices for 3 minutes.**
- **Participants must maintain progressively challenging static standing positions. Each position must be help for 50 sec. to be scored as a completed trial.**
- **Participants are instructed to stand with their hands on their shoulders and armed crossed across the chest.**
- **Detailed exclusion criteria are in place to screen out people with decreased sensation in the feet, obesity, joint pain, stroke, Parkinson’s disease, known balance impairments, history of falls, and visual impairments.**
- **Emotional:** Minimal-Moderate. Participant may experience a fear of falling or sense of insecurity in some testing positions.

Accessibility Issues and Accommodations

1. **Feature:** Testing conditions 1, 3, and 5 require the participant to have their eyes open so that they can use vision as a means to control balance. A participant must successfully complete the eyes open conditions to proceed to eyes closed.
Problem: Even if a person who is blind keeps their eyes open they are not able to use visual cues to help maintain balance rendering their scores invalid for the eyes open conditions.
Solution: Omit this measure for all people who are blind not just those with conditions listed in the exclusions. Document reason for exclusion.

2. Feature: All instructions are provided verbally with demonstration.
Problem: May be inaccessible to people who are deaf or hard of hearing.
Solution: Provide instructions in an alternate accessible format, e.g. written text with images or ASL with demonstration
**Does not alter task demands document as standard administration.

NIH TOOLBOX 4-METER WALK GAIT SPEED TEST

Description: This performance-based measure assesses gait speed.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally with demonstration.
- **Visual:** Minimal.
- **Reading:** None.
- **Speech:** None.
- **Cognitive:** Minimal. Participant must understand the concept the task demands.
- **Motor: Moderate. Participant must have sufficient motor function to walk with or without the use of an assistive device over a short (4m) flat course at their usual or comfortable walking speed.**
- **Emotional:** Minimal.

Accessibility issues and accommodations

- Feature:** Walking course is marked with visual cues for starting and stop lines.

Problem: People with low vision or blindness cannot see the start and stop lines. Unfamiliarity with the walking course may alter gait speed.

Solution: Orient the participant to the course prior to the timed trial by providing verbal description of the course and allow the participant to “walk the course” prior to the timed trials.

**Does not alter task demand document as standard administration.
- Feature:** All instructions are provided verbally with demonstration.

Problem: Instructions may be inaccessible to people who are deaf or hearing impaired.

Solution: Provide instructions in alternate accessible formats e.g. ASL or print.

**Does not alter task demand document as standard administration.
- Feature:** Participant must be able to walk 4 meters without human assistance.

Problem: There may be safety concerns for people who use assistive devices to walk. People who walk with a cane, walker, or crutches can perform this measure as it entails not more risk than they would encounter in a typical day.

Solution: If there are safety concerns for people who walk mobility aids, administrator may walk with the person and have a chair available at the start and stop lines. Note for people with a lot of fatigue the demands of getting in and out of a chair may be higher than for walking. Discuss options with the participant to determine their preferences.

This project is funded in whole or in part with Federal funds from the Blueprint for Neuroscience Research and the Office of Behavioral and Social Sciences Research, National Institutes of Health, under Contract No. HHS-N-260-2006-00007-C and from the National Institute on Disability and Rehabilitation Research: Rehabilitation Research and Training Center on Improving Measurement of Medical Rehabilitation Outcomes (H133B090024)

4. Feature: Participant must be able to walk 4 meters without human assistance.
Problem: Measure is inaccessible to people who are non-ambulatory.
Solution: Omit measure for wheelchair users.
**Document reason for omission.

NIH TOOLBOX 2-MINUTE WALK ENDURANCE TEST

Description: This performance-based measure assesses cardiovascular endurance by measuring how far a person can walk in 2 minutes.

Task Demands

- **Auditory:** Moderate. Instructions are provided verbally with demonstration.
- **Visual:** Moderate. Participant must have sufficient visual acuity to walk safely on the 50' course.
- **Participants must be able to see a small cone marking the ends of the course.** The participant must be able to safely circle the cones.
- **Reading:** None.
- **Speech:** None.
- **Cognitive:** Minimal. Participant must understand the task demands.
- **Motor:** High. Participant must be able to walk safely with or without an assistive device for 2-minutes. Participants may rest as needed.
- **Emotional:** Minimal. Participant may experience some emotional reactions to lost motor functions.

Accessibility issues and accommodations

1. **Feature:** Walking course is marked with visual cues for starting and stop lines.
Problem: People with low vision or blindness cannot see the start and stop lines.
Unfamiliarity with the walking course may alter gait speed.
Solution: Orient the participant to the course prior to the timed trial by providing verbal description of the course and allow the participant to “walk the course” prior to the timed trials.
Provide tactile cues at the turn points, such as securely fastened flooring with a different texture so that people who navigate with white canes can distinguish the turning points.
Remove cones which may pose a trip hazard.
**Document as non-standard administration.
2. **Feature:** All instructions are provided verbally with demonstration.
Problem: Instructions may be inaccessible to people who are deaf or hearing impaired.
Solution: Provide instructions in alternate accessible formats e.g. ASL or print.
**Does not alter task demand document as standard administration.
3. **Feature:** Walking course is marked with cones at the end of the course.
Problem: Cones may be a trip hazard for people with decreased balance or who use some assistive devices like a cane or a walker.

- Solution: Orient the participant to the course prior to the timed trial and then remove the cones. The tape lines on the floor will still serve as visual marker of when to turn but administrator should monitor turns to ensure the participant does not cut corners or add extra distance.
**Does not alter task demand document as standard administration.
4. Feature: Participant must be able to walk 2 minutes without human assistance.
Problem: Measure is inaccessible to people who are non-ambulatory.
Solution: Omit measure for wheelchair users.
**Document reason for omission.
5. Feature: Participant must be able to walk 2 minutes without human assistance.
Problem: May be fatiguing for some participants but as this is a measure of endurance some fatigue is to be expected.
Solution: Reinforce with the participant that they may rest when/if they need to but should continue walking as soon as they are able.
6. Feature: Participant must be able to walk for 2 minutes without human assistance.
Problem: There may be safety concerns for people who use assistive devices to walk. People who walk with a cane, walker, or crutches can perform this measure as it entails not more risk than they would encounter in a typical day.
Solution: If there are safety concerns for people who walk mobility aids, administrator may walk the person (slightly behind). If appropriate participant may wear a gait belt and receive stand by assistance from the administrator.
Discuss options with the participant to determine their preferences.