Introducing V3

Assessment of

Cognition    Motor    Sensation    Emotion

Ages 3-85+

NIHToolbox.org
NIH Toolbox® V3

Over 50 digital assessments of Cognition, Motor, Sensation, and Emotion in one iPad app. Our valid, reliable and norm-referenced tests allow for the assessment of participants across the lifespan (3 to 85+ years).

What’s New in V3?

2006
The NIH Blueprint for Neuroscience awarded a contract under the leadership of Dr. Richard Gershon, Principal Investigator, and a team of +250 scientists across 80 academic institutions, to develop a brief, standardized assessment of neurobehavioral function to enhance data collection.

2012
Version 1 of the NIH Toolbox released to the research community as a web-based system.

2015
In response to demand for a more portable assessment system, Version 2 of the NIH Toolbox launched to researchers and clinicians on the App Store for iPad.

2021
Collected updated normative data for select NIH Toolbox tests aligned with the US 2020 Census.

2023
The NIH Toolbox Version 3 iPad app rolled out with improved UI and UX capabilities, user-friendly administration features, streamlined tests and updated scoring algorithms.

Overview of V3 Development

The NIH Toolbox V3 app offers a redesigned interface that incorporates input from usability and accessibility experts to enhance its user experience for both the examiners and their participants. Users will find an easy-to-navigate interface, allowing for the ready selection and administration of tests. Once the assessment is complete, results can be accessed through a Score Report or .CSV file.

As part of the V3 update, a new normative sample was collected for the NIH Toolbox Cognition Tests, and the Standing Balance Test (Motor Domain). A total of 3,900 participants ages 3–85+ were collected and their demographics were representative of the 2020 US Census. Data collection was performed by trained examiners across the US with 17% of cases collected in the Northeast, 36% in the South, 23% in the Midwest, and 24% in the West.

Users will also find updates on norm calculations for the NIH Toolbox V3 Cognition Tests and the Standing Balance Test, which have continuous norms that use chronological age in years, half-years, or quarter-years, depending on the participant’s age. Change-sensitive scores are available for core Cognition Tests, as well as a norming approach that is based on the change-sensitive scores.

For other tests, in the Emotion, Motor, and Sensation Domains, the normative data was pulled forward from V2. Users will find other updates across these domains, such as a new scoring engine for Emotion Computer Adaptive Tests (CAT) which will allow for shorter, more targeted administrations. Please see the NIH Toolbox V3 Manuals for more detailed information.
Cognition refers to the mental processes involved in gaining knowledge and comprehension, such as thinking, knowing, remembering, judging, and problem solving.

NIH Toolbox Cognition Tests produce individual test scores, and cognition batteries produce composite scores by age. Supplemental tests not used in the calculation of composites can be administered to better understand the participant’s cognitive functioning.

Ages 7+ Composites

Total Cognition Composite =

Crystalized Composite: Picture Vocabulary & Oral Reading Recognition tests.

Fluid Composite: Dimensional Change Card Sort, Flanker, Picture Sequence Memory, List Sorting, & Pattern Comparison tests.

Early Childhood Composite =

Dimensional Change Card Sort, Flanker, Picture Sequence Memory, Picture Vocabulary, & Speeded Matching tests.

Ages 3–6 Composite

Total Cognition Composite =

Fluid Composite: Dimensional Change Card Sort, Flanker, Picture Sequence Memory, List Sorting, & Pattern Comparison tests.

Cognition Tests

<table>
<thead>
<tr>
<th>TEST</th>
<th>SUBDOMAIN</th>
<th>DESCRIPTION</th>
<th>AGE IN YEARS</th>
<th>ADMIN TIME IN MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanker Inhibitory Control and Attention Test</td>
<td>Attention, Executive Function</td>
<td>Assess the ability to focus attention and inhibit automatic response tendencies that can interfere with goal attainment.</td>
<td>4+</td>
<td>3</td>
</tr>
<tr>
<td>Dimensional Change Card Sort Test</td>
<td>Executive Function</td>
<td>Measure the capacity for switching among multiple aspects of a strategy or task.</td>
<td>4+</td>
<td>4</td>
</tr>
<tr>
<td>Visual Reasoning Test</td>
<td>Executive Function</td>
<td>Examine the ability to identify patterns and rules, integrate the information and apply it to solve problems.</td>
<td>4+</td>
<td>7</td>
</tr>
<tr>
<td>Oral Reading Recognition Test</td>
<td>Language, Expressive</td>
<td>Assess reading ability which is a robust measure of verbal intelligence.</td>
<td>7+</td>
<td>4</td>
</tr>
<tr>
<td>Picture Vocabulary Test</td>
<td>Language, Receptive</td>
<td>Measure word knowledge which has a high association with overall intelligence ('g-factor').</td>
<td>3+</td>
<td>3</td>
</tr>
<tr>
<td>Face Name Associative Memory Exam Test</td>
<td>Memory, Learning, Delayed, Visual, Immediate</td>
<td>Examine the capability to learn a set of twelve faces and names and the ability to recall them later.</td>
<td>18+</td>
<td>7</td>
</tr>
<tr>
<td>List Sorting Working Memory Test</td>
<td>Memory, Working</td>
<td>Assess the ability to process, store and manipulate information across a series of tasks.</td>
<td>5+</td>
<td>7</td>
</tr>
<tr>
<td>Picture Sequence Memory Test</td>
<td>Memory, Episodic</td>
<td>Investigate the time needed to memorize a sequence of pictures and reproduce it.</td>
<td>3+</td>
<td>7</td>
</tr>
<tr>
<td>Rey Auditory Verbal Learning Test</td>
<td>Memory, Learning, Immediate, Delayed, Verbal</td>
<td>Assess the ability to learn a list of 15 words over three repeat trials and recall them after delay.</td>
<td>5+</td>
<td>4</td>
</tr>
<tr>
<td>Oral Symbol Digit Test</td>
<td>Processing Speed</td>
<td>Examine the ability to quickly process information through matching symbols with digits.</td>
<td>5+</td>
<td>3</td>
</tr>
<tr>
<td>Pattern Comparison Processing Speed Test</td>
<td>Processing Speed</td>
<td>Examine the speed of visually detecting whether two stimuli are the same or different.</td>
<td>5+</td>
<td>4</td>
</tr>
<tr>
<td>Speeded Matching Test</td>
<td>Processing Speed</td>
<td>Measure the speed of selecting a target picture amongst distractors.</td>
<td>3–6</td>
<td>3</td>
</tr>
</tbody>
</table>
Motor function involves complex physiological processes and requires the integration of multiple systems, including neuromuscular, musculoskeletal, cardiopulmonary, neural motor and sensory-perceptual systems.

Motor Tests

<table>
<thead>
<tr>
<th>TEST</th>
<th>SUBDOMAIN</th>
<th>DESCRIPTION</th>
<th>AGE IN YEARS</th>
<th>ADMIN TIME IN MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Minute Walk Endurance Test</td>
<td>Endurance</td>
<td>Measure of overall physical fitness and endurance, which requires one to walk at a normal speed on a flat surface for 2 minutes.</td>
<td>3+</td>
<td>4</td>
</tr>
<tr>
<td>4-Meter Walk Gait Speed Test</td>
<td>Locomotion</td>
<td>Assess locomotion by walking 4 meters at a normal speed on a flat surface.</td>
<td>7+</td>
<td>3</td>
</tr>
<tr>
<td>9-Hole Pegboard Dexterity Test</td>
<td>Dexterity</td>
<td>Examine fine motor dexterity by placing 9 pegs into a board with 9 holes, then removing them as quickly as possible.</td>
<td>3+</td>
<td>4</td>
</tr>
<tr>
<td>Grip Strength Test</td>
<td>Strength</td>
<td>Measure upper extremity strength by squeezing a hand dynamometer as hard as they can, one hand at a time.</td>
<td>3+</td>
<td>3</td>
</tr>
<tr>
<td>Standing Balance Test</td>
<td>Balance</td>
<td>Assess balance by performing a series of poses on the ground and on a foam pad.</td>
<td>3+</td>
<td>7</td>
</tr>
</tbody>
</table>

Motor function is indicative of current physical health status, burden of disease and long-term health outcomes, and is integrally related to daily functioning and quality of life.

Note: All Motor Tests require additional equipment to properly administer.

Motor Battery

Recommended for ages 7+:
9-Hole Pegboard Dexterity, Grip Strength, Standing Balance, 4-Meter Walk Gait Speed, & 2-Minute Walk Endurance tests.

Early Childhood Motor Battery

Recommended for ages 3-6:
9-Hole Pegboard Dexterity, Grip Strength, Standing Balance, & 2-Minute Walk Endurance tests.
Sensation refers to the biochemical and neurologic process of detecting incoming nerve impulses as nervous system activity. Sensory processes are vital to one’s level of independence in relationships with others, academic and occupational endeavors, and activities of daily living.

Objective measures of sensation can systematically examine and determine if one has intact sensory functioning. Given the changes in sensory functioning across the lifespan, there is value in characterizing age-related sensory improvement and decline.

Recommended Inclusion of Additional Tests at Older Ages

Recommended for Ages 3-6+

<table>
<thead>
<tr>
<th>Test</th>
<th>Subdomain</th>
<th>Description</th>
<th>Age in Years</th>
<th>Admin Time in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor Identification Test</td>
<td>Olfaction</td>
<td>Assess olfaction by identifying and naming odors on scratch-and-sniff cards.</td>
<td>3+</td>
<td>4</td>
</tr>
<tr>
<td>Pain Intensity Test</td>
<td>Pain</td>
<td>Assess one’s level of pain in the past 7 days.</td>
<td>18+</td>
<td>1</td>
</tr>
<tr>
<td>Pain Interference Test</td>
<td>Pain</td>
<td>Assess how much pain has interfered or affected one’s enjoyment of activities in the past 7 days.</td>
<td>18+</td>
<td>1</td>
</tr>
<tr>
<td>Regional Taste Intensity Test</td>
<td>Taste</td>
<td>Measure taste sensitivity by asking one to rate the intensity of salty and bitter solutions on the tip of their tongue and mouth.</td>
<td>12+</td>
<td>6</td>
</tr>
<tr>
<td>Visual Acuity Test</td>
<td>Vestibular</td>
<td>Assess distance vision by having one sit 3 meters away and identify letters as they appear on the screen.</td>
<td>3+</td>
<td>3</td>
</tr>
<tr>
<td>Words-In-Noise Test</td>
<td>Audition</td>
<td>Assess the ability to detect, discriminate and localize speech in a noisy background.</td>
<td>6+</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: Some Sensation Tests require additional equipment to properly administer.
Emotion refers to any strong feelings, such as joy, sorrow, or fear. It is an affective state of consciousness in which one of these feelings is experienced, as distinguished from cognitive and volitional states of consciousness.

Test items are presented in a self-report format and a parent proxy-report for younger children.

<table>
<thead>
<tr>
<th>TEST</th>
<th>SUBDOMAIN</th>
<th>DESCRIPTION</th>
<th>AGE IN YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>Negative Affect</td>
<td>Assess irritability, frustration, interpersonal sensitivity, envy, disagreeableness, and efforts to control anger. (FF, CAT)</td>
<td>3+</td>
</tr>
<tr>
<td>Apathy</td>
<td>Negative Affect</td>
<td>Evaluate deficits in goal-oriented behavior and decrements in goal-related thought. (FF)</td>
<td>18+</td>
</tr>
<tr>
<td>Emotional Support</td>
<td>Social Relationships</td>
<td>Assess one’s perception that their social network is available to listen to their problems with empathy, caring, and understanding. (CAT)</td>
<td>18+</td>
</tr>
<tr>
<td>Empathic Behaviors</td>
<td>Social Relationships</td>
<td>Measure a parent’s perception of their child’s prosocial behaviors. (CAT)</td>
<td>3–12</td>
</tr>
<tr>
<td>Fear/Anxiety</td>
<td>Negative Affect</td>
<td>Assess one’s feelings of fear, anxious misery, hyperarousal, and somatic symptoms related to arousal. (CAT)</td>
<td>18+</td>
</tr>
<tr>
<td>Friendship</td>
<td>Social Relationships</td>
<td>Assess the availability of friends or companions with whom to interact or affiliate. (CAT)</td>
<td>8+</td>
</tr>
<tr>
<td>General Life</td>
<td>Psychological Well-Being</td>
<td>Assess one’s cognitive evaluation of life experiences and whether they like their life. (CAT, FF)</td>
<td>3+</td>
</tr>
<tr>
<td>Instrumental Support</td>
<td>Social Relationships</td>
<td>Assess one’s perception that people in their social network are available to provide material or functional aid in completing daily tasks, if needed. (CAT)</td>
<td>18+</td>
</tr>
<tr>
<td>Loneliness</td>
<td>Social Relationships</td>
<td>Assess one’s perceptions of being alone, lonely, or socially isolated from others. (FF)</td>
<td>8+</td>
</tr>
<tr>
<td>Meaning and Purpose</td>
<td>Psychological Well-Being</td>
<td>Assess one’s feelings around whether life has purpose and there are good reasons for living. (CAT)</td>
<td>18+</td>
</tr>
<tr>
<td>Peer Rejection</td>
<td>Social Relationships</td>
<td>Assess how often one is left out, avoided, or teased by peers. (CAT)</td>
<td>3–12</td>
</tr>
<tr>
<td>Perceived Hostility</td>
<td>Social Relationships</td>
<td>Evaluate one’s perceptions of hostility in their daily social interactions. (CAT, FF)</td>
<td>8+</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>Psychological Well-Being</td>
<td>Measure feelings of pleasurable engagement with the environment, such as happiness, joy, excitement, enthusiasm, and contentment. (CAT)</td>
<td>3+</td>
</tr>
<tr>
<td>Sadness/Depression</td>
<td>Negative Affect</td>
<td>Evaluate poor mood and negative perceptions of the self, the world, and the future. (CAT)</td>
<td>3+</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Stress and Self-Efficacy</td>
<td>Measure one’s capacity to manage problems and have control over meaningful events. (CAT)</td>
<td>8+</td>
</tr>
<tr>
<td>Social Withdrawal</td>
<td>Social Relationships</td>
<td>Assess the perception of being alone, lonely, or socially isolated from others. (FF)</td>
<td>3–12</td>
</tr>
</tbody>
</table>

All tests are administered in 2 minutes or less. *Computer Adaptive Test = CAT; Fixed Form = FF *

Note: This listing is only a representative sample of included Emotion Tests. For a full list, visit our website or app.
Thank you to the hundreds of scientific experts who helped to develop, maintain, and support the NIH Toolbox over the years.

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