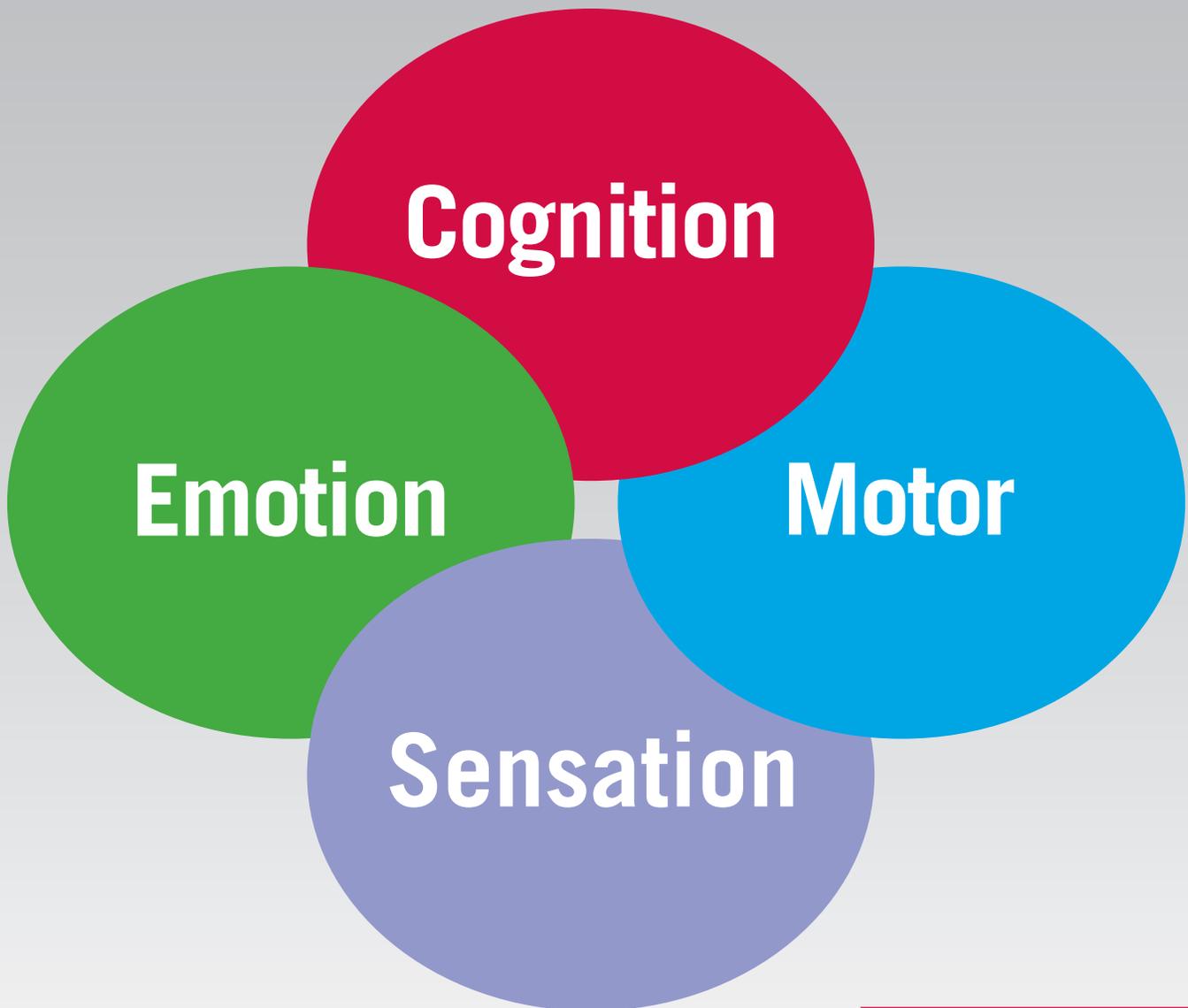




For Assessment of Neurological
and Behavioral Function®

NIH Toolbox® is a multi-dimensional set of brief, royalty-free measures to assess cognitive, sensory, motor and emotional function that can be administered in two hours or less across diverse study designs and settings.



Available for use on iPad

Four domain level
batteries available in
English and Spanish

Developed by more
than 250 contributing
scientists at 80 institutions

Individual measures
nationally normed
for ages 3-85



For Assessment of Neurological and Behavioral Function®

NIH TOOLBOX HISTORY

In 2004, the 15 Institutes, Centers and Offices at NIH that support neuroscience research formed a coalition called the Blueprint for Neuroscience Research. The NIH Blueprint goal was to develop new tools, resources, and training opportunities to accelerate the pace of discovery in neuroscience research. Because the research community had long sought the development of standard instruments to measure cognitive and emotional health, in 2006 the NIH Blueprint awarded a contract to develop an innovative approach to meet this need. Under the leadership of Dr. Richard Gershon, Principal Investigator, a team of more than 250 scientists from nearly 80 academic institutions were charged with developing a set of state-of-the-art tools to enhance data collection in large cohort studies and to advance the neurobehavioral research enterprise.

WHAT IS THE NIH TOOLBOX?

The NIH Toolbox provides a standard set of royalty-free, comprehensive assessment tools that can be used by researchers and clinicians in a variety of settings, with a particular

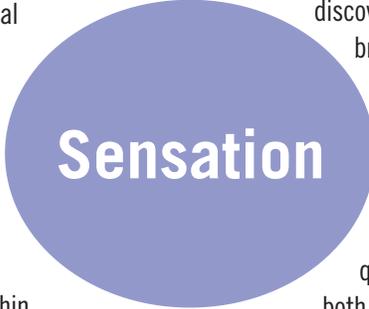
emphasis on measuring outcomes both in longitudinal epidemiologic studies and prevention or intervention trials. The battery has been normed

and validated across the lifespan in subjects ages 3-85 and its use ensures that assessment methods and

results can be used for comparisons across existing and future studies. By providing a “common currency” for the study of neurological research, the NIH Toolbox enables economies of scale and enhances efficiency. The NIH Toolbox is capable of monitoring neurological and behavioral function over time and measuring key constructs across developmental stages.

THE NIH TOOLBOX BATTERIES

The NIH Toolbox can be administered within two hours and divides tests into four domain batteries: Cognition, Sensation, Motor and Emotion. In addition, within some domains, there are supplemental measures that can be administered.



IMPACT OF THE NIH TOOLBOX ON NEUROLOGICAL RESEARCH

Prior to the NIH Toolbox, there were many studies that collected information on aspects of neural function (cognition, sensation, motor, emotion) with little uniformity among the measures used to assess these constructs. Moreover, few studies included capturing information in all four domains because including such breadth of information would be costly in terms of time and subject burden. With the advent of the NIH Toolbox, researchers can now assess function using a common metric and can “crosswalk” among measures, supporting the pooling and sharing of large data sets. The NIH Toolbox supports scientific

discovery by bringing a common language to important research questions both with respect to the primary study aims and to those arising from secondary data analyses. The four batteries provide researchers with streamlined measures that have minimal subject burden and cost.

SELECTION OF THE NIH TOOLBOX DOMAINS AND SUB-DOMAINS

NIH Project Team members determined the breadth of the NIH Toolbox to include the domains of Cognition, Motor, Emotion, and Sensation. Initial literature and database reviews and a Request for Information of NIH-funded researchers identified the sub-domains for inclusion in the NIH Toolbox, existing measures relevant to the project goals, and criteria for instrument selection. NIH Project Team members, external content experts, and contract scientists met at a follow-up consensus meeting to discuss potential sub-domains along with the criteria for instrument selection, creation, and norming. Additional expert interviews were undertaken to gather more detailed information from clinical and scientific experts to help further refine the list of possible sub-domains. A second consensus group meeting was held and results directed the selection of the sub-domains within each core domain area to be measured in the final NIH Toolbox.

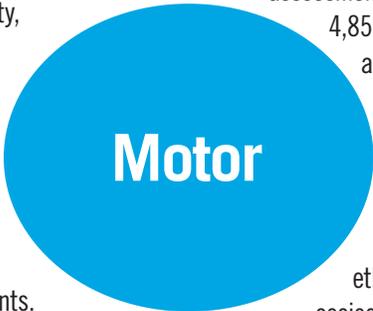
“Common Currency” across diverse study designs and populations

Measures the same constructs over the lifespan

eLearning and face-to-face training

SELECTION OF MEASURES FOR THE NIH TOOLBOX

More than 1,400 existing measures were identified and evaluated for inclusion in the NIH Toolbox. The selection criteria included a measure's applicability across the life span, psychometric soundness, brevity, ease of use, applicability in diverse settings and with different groups, and lack of intellectual property constraints.



Motor

VALIDATION

Validation studies were conducted for all NIH Toolbox measures to assure that these important tools for research met rigorous scientific standards. Studies were conducted across the entire age range, typically included 450-500 subjects, and were statistically compared against "gold standard" measures whenever available. For tests using Item Response Theory approaches to scoring, calibration samples generally included several thousand participants, ensuring robust models. In total, data was collected from more than 16,000 subjects as

part of field-test, calibration and validation activities.

NORMING

NIH Toolbox conducted a large national standardization study in both English and Spanish languages to allow for normative comparisons on each assessment. A sample of 4,859 participants, ages 3-85, representative of the U.S. population based on gender, race/ethnicity, and socioeconomic

status was administered all of the NIH Toolbox measures at sites around the country. NIH Toolbox normative scores are now available for each year of age from 3 through 17, as well as for ages 18-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80-85, allowing for targeted, accurate comparisons for any research study participant groups against the U.S. population.

ADVANCED MEASUREMENT TECHNIQUES

The NIH Toolbox measures utilize several advanced approaches in item development, test

construction, and scoring. Two of these are Item Response Theory (IRT) and Computer Adaptive Testing (CAT). Item Response

Theory allows tests to be brief, yet still precise and valid. Using IRT methodology, sets of items are calibrated along a continuum that covers the full range of the construct to be measured. This calibrated set of items enables the creation of Computer Adaptive Testing. CAT is a specialized type of computer-based testing that enables frequent assessments and immediate feedback with minimal burden on participants and precise evaluation at the individual level. Users can administer short, unique tests to every individual, with reliability and scores equivalent to longer, fixed-length assessments.

EARLY CHILDHOOD USE

Development of the NIH Toolbox instruments focused special attention on assessing young children, to ensure that all tests given would be developmentally appropriate for ages 3-7. An expert team of early childhood



Emotion

assessment consultants was engaged to provide testing guidelines for the very young, to offer input on measure development, and to review all NIH Toolbox measures as they relate to the needs of young children.

NIH TOOLBOX APP

Released in 2015, the NIH Toolbox iPad® app takes advantage of portable technology and advanced software to provide users with a flexible and easy-to-use NIH Toolbox test administration and data collection system. App features, including internet-free test administration, enhanced normative scores, individual participant reports, multiple data export options and both in-app and email customer support, are designed to facilitate use in diverse clinical, research and educational settings. A study (N=600) evaluating the equivalency of the NIH Toolbox web-based and app versions of Cognition showed that, after adjustments to the scores of 4 tests, the web-based normative scores can also be applied to results obtained from the app.

BEFORE NIH TOOLBOX	AFTER NIH TOOLBOX
Custom measures could not easily be compared across studies	Standardized measures easily compared across studies Validated against "gold standard" instruments
Assessments typically limited to looking at cognitive variables	Easily incorporate multiple areas of neurological functioning (motor, emotion, sensation)
Expensive equipment and per-subject royalty fees	Inexpensive equipment, no royalties, low per-subject costs (per-subject costs limited to taste and olfaction materials)
Time-consuming measures often required highly trained administrators	Cutting-edge, brief, psychometrically sound measures can be administered with minimal expertise

Adaptable to any language

Reduces subject burden

Supplemental Measures

Cognition

Cognition refers to the mental processes involved in gaining knowledge and comprehension, such as thinking, knowing, remembering, judging, and problem-solving. These higher-level functions of the brain encompass language, imagination, perception, and the planning and execution of complex behaviors. Measurement of cognition is essential to any study of health and well-being, and should be included in large-scale epidemiologic studies and experimental studies of health and development, even if the target of the study is not cognition itself.

NIH Toolbox Cognition Battery

This battery, recommended for ages 7+, consists of tests to assess Executive Function, Attention, Episodic Memory, Language, Processing Speed and Working Memory. Administering this battery will yield the following summary scores, in addition to individual measure scores: Cognitive Function Composite Score, Fluid Cognition Composite Score (includes DCCS, Flanker, Picture Sequence Memory, List Sorting, and Pattern Comparison measures), and Crystallized Cognition Composite Score (includes Picture Vocabulary and Reading Recognition measures).

NIH Toolbox Early Childhood Cognition Battery

This battery, recommended for ages 3-6, includes the DCCS, Flanker, Picture Sequence Memory, and Picture Vocabulary measures. In addition to individual measure scores, administering this battery will yield an Early Childhood Composite Score.

Attention

Attention refers to the allocation of one’s limited capacities to deal with an abundance of environmental stimulation. It is the foundation for all other types of mental processes. There are several different forms of attention, including sustained, selective, and divided. Sustained attention is closely linked to the level of wakefulness or the maintenance of an alert state. Selective attention serves to direct sensory and thought processes to a particular stimulus or sector of the visual field so that action can be taken. Divided attention is the ability to attend to more than one stimulus, spatial sector or modality simultaneously, and overlaps with Executive Function.

NIH Toolbox Flanker Inhibitory Control and Attention Test



Episodic Memory

Episodic Memory refers to cognitive processes involved in the acquisition, storage and retrieval of new information. It involves conscious recollection of information learned within a context. The term “learning” refers to the acquisition of skills and knowledge, while the term “memory” refers to the persistence of this learning over time and/or the facility with which one is able to spontaneously recall the information following a delay. Episodic Memory can be verbal, as in remembering a conversation or a list of grocery items, or nonverbal, as in imagining a place one visited or a picture one saw a week earlier.

NIH Toolbox Picture Sequence Memory Test



Working Memory

Working Memory refers to the ability to store information until the amount of information to be stored exceeds one’s capacity to hold that information. Working memory refers to the capacity of an individual to process information across a series of tasks and modalities, hold the information in a short-term buffer, manipulate the information, and hold the products in the same short-term buffer. This concept updates the traditional construct of “short-term memory,” which refers to a passive storage buffer, to include the notion of an active computational workspace.

NIH Toolbox List Sorting Working Memory Test



Language

Language refers to a set of mental processes that translate thought into symbols (i.e., words and gestures), which can be shared among individuals for purposes of communication. NIH Toolbox focuses on two aspects of language. The first aspect is receptive word knowledge, which is fundamental to learning and which has a very high association with overall intelligence (or what has been called the “g-factor”). The second aspect taps reading, which is defined as the cognitive process of deriving meaning from text, and is reflective of the level and quality of prior educational experiences. An oral reading measure provides a fairly robust indication of verbal intelligence that is relatively undisturbed by many medical conditions that affect the brain.

NIH Toolbox Picture Vocabulary Test



NIH Toolbox Oral Reading Recognition Test



Executive Function

Executive Function is the capacity to plan, organize, and monitor the execution of behaviors that are strategically directed in a goal-oriented manner. The NIH Toolbox Executive Function measures focus on the inhibition of automatic response tendencies that may interfere with achieving a goal, as well as set shifting, or the capacity for switching among multiple aspects of a strategy or task.

NIH Toolbox Flanker Inhibitory Control & Attention Test



NIH Toolbox Dimensional Change Card Sort Test



Processing Speed

Processing Speed is defined as either the amount of time it takes to process a set amount of information, or, conversely, the amount of information that can be processed within a certain unit of time. It is a measure that reflects mental efficiency. Processing Speed is central for many cognitive functions and domains and is sensitive to change and/or disease.

NIH Toolbox Pattern Comparison Processing Speed Test



Expert Contributors-Cognition

Sandra Weintraub, PhD (Northwestern University), chair. Patricia Bauer, PhD (Emory University), Noelle Carlozzi, PhD (University of Michigan), Kevin Conway, PhD (NIH/National Institute on Drug Abuse), Sureyya Dikmen, PhD (University of Washington), Emmeline Edwards, PhD (NIH/National Center for Complementary and Integrative Health), Nathan Fox, PhD (University of Maryland), Lisa Freund, PhD (NIH/Eunice Kennedy Shriver National Institute of Child Health and Human Development), Richard Gershon, PhD (Northwestern University), Richard Havlik, MD (Westat, Inc.), Robert Heaton, PhD (University of California-San Diego), Jonathan King, PhD (NIH/National Institute on Aging), Jennifer Manly, PhD (Columbia University), Claudia Moy, PhD (NIH/National Institute of Neurological Disorders and Stroke), Dan Mungas, PhD (University of California-Davis), Jerry Slotkin, PhD (University of Delaware), David Tulskey, PhD (University of Delaware), Ellen Witt, PhD (NIH/National Institute on Alcohol Abuse and Alcoholism), Philip Zelazo, PhD (University of Minnesota)

KEY:



Proctored tests require active administrator participation throughout the test.

Self-administered measures are completed independently by the subject but may still require proctor assistance at the beginning of the assessment to provide instructional or practice help.

Hands-on measures include some sort of activity typically including movement.

Tablet-administered measures involve active interaction with the tablet by the subject. (Note: All of the Toolbox measures have been designed for tablet-based data collection).

Supplemental Measures

NIH Toolbox Oral Symbol Digit Test (ages 8+)
NIH Toolbox Auditory Verbal Learning Test (Rey) (ages 8+)

Scan the Cognition QR code for detailed features, equipment and materials requirements, current studies, papers, and presentations



Sensation

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 participants have intact sensory functioning. There is also fundamental overlap of certain sensory processes with cognitive and motor functioning. Measurement of sensory health and function is important to epidemiologic and longitudinal studies whether or not sensation is the primary focus of the study. Given the changes in sensory functioning across the lifespan, there is value in characterizing age-related sensory improvement and decline.

NIH Toolbox Sensation and Pain Battery

This battery, recommended for ages 7+, consists of tests to assess Audition, Visual Acuity, Olfaction, and Pain (Ages 18+). A Taste test (Ages 12+) is available as an individual measure.

Audition

Audition involves both the physical processing of acoustic signals (e.g., intensity and frequency) and their psychological percepts (e.g., loudness and pitch). In the process of hearing, people detect, discriminate and localize a wide variety of stimuli, including linguistic sounds (e.g., speech syllables, words, sentences), and non-linguistic sounds (e.g., clicks, tones, music). The NIH Toolbox includes an assessment of the ability to understand speech in a noisy background, because a substantial portion of communication in the real world occurs in less-than-ideal environments. Note: two audition supplemental instruments were also created: NIH Toolbox Hearing Threshold Test (Age 6+) and NIH Toolbox Hearing Handicap Inventory (Age 6+).

NIH Toolbox Words-in-Noise Test

Vision

Vision is a complex sensation that provides us with a personal, conscious representation of our surrounding environment. Loss of vision or blindness may limit a person's ability to complete normal, daily activities and decrease overall quality of life. The key aspect of vision prioritized for testing in the NIH Toolbox is visual acuity. Visual acuity tests are used to measure impairments in visual resolution that can be caused by blurring of the retinal image, neural processing disorders, or damage to neurons in the retina or other parts of the visual pathway. Note: a supplemental instrument was also created: NIH Toolbox Vision-Related Quality of Life Survey (Age 18+).

NIH Toolbox Visual Acuity Test

Vestibular

The vestibular system converts and processes angular and linear acceleration and deceleration of the head, enabling postural balance, locomotor control, and gaze stabilization, particularly during head movement.

The vestibular system is an integral component of our sensory experience and sensory-motor function. NIH Toolbox measures functionally relevant gaze stability during head motion as well as postural control.

Please contact help@nihtoolbox.org regarding availability of the NIH Dynamic Visual Acuity Test.

NIH Toolbox Dynamic Visual Acuity Test

Olfaction

The human olfactory system allows us to detect odors, to recognize and discriminate odor qualities, and to identify the sources of odors in our world. Our sense of smell provides us with information about our air, water, and food that is critical to our health and safety, nutrition, and psychological well-being. In addition, impaired olfactory function is now recognized as one of the early signs of several neurodegenerative disorders, including Alzheimer's and Parkinson's Disease. While there are multiple approaches to olfactory measurement, odor identification was chosen for Toolbox because it is an effective, brief and inexpensive method and does not require specialized equipment or training of the examiners.

NIH Toolbox Odor Identification Test



Expert Contributors-Audition

Steven Zecker, PhD (Northwestern University), chair. Sumit Dhar, PhD (Northwestern University), Judy Dubno, PhD (Medical University of South Carolina), David Eddins, PhD (University of South Florida), Robert Frisina, PhD (University of South Florida), James Griffith, PhD (Northwestern University), Howard Hoffman, MA (NIH/National Institute on Deafness and Other Communication Disorders), Nina Kraus, PhD (Northwestern University), Margaret Wallhagen, PhD (University of California, San Francisco), Joseph Walton, PhD (University of South Florida), Richard Wilson, PhD (Mountain Home VA Medical Center-Tennessee)

Expert Contributors-Vision

Rohit Varma, MD (University of Southern California), chair. Eileen Birch, PhD (Retina Foundation of the Southwest), Karen Cruickshanks, PhD (University of Wisconsin), Ron Hays, PhD (University of California-Los Angeles), Chris Johnson, MSc, PhD, Dsc (University of Iowa), Paul Lee, MD, JD (University of Michigan), Maureen Maguire, PhD (University of Pennsylvania), Robert Massof, PhD (The Johns Hopkins University), Cynthia Owsley, PhD (University of Alabama-Birmingham), Michael Repka, MD (The Johns Hopkins University), Jerry Slotkin, PhD (University of Delaware), Susan Vitale, PhD (NIH/National Eye Institute), Michael Wall, MD (University of Iowa)

KEY:



Proctored tests require active administrator participation throughout the test.

Self-administered measures are completed independently by the subject but may still require proctor assistance at the beginning of the assessment to provide instructional or practice help.

Hands-on measures include some sort of activity typically including movement.

Tablet-administered measures involve active interaction with the tablet by the subject. (Note: All of the Toolbox measures have been designed for tablet-based data collection).

Pain

Pain has been defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Pain is a major symptom in many medical conditions, and can significantly interfere with a person's quality of life and general functioning. The NIH Toolbox measures of pain focus on a participant's reported pain experience, as well as the intensity of the pain experienced.

NIH Toolbox Pain Intensity Survey



NIH Toolbox Pain Interference Survey



Expert Contributors-Vestibular

Rose Marie Rine, PhD (Specialty Therapy LLC and Marshall University), chair. John Carey, MD (The Johns Hopkins University), Howard Hoffman, MA (NIH/National Institute on Deafness and Other Communication Disorders), Gary Jacobson, PhD (Vanderbilt University), Gregory Marchetti, PhD (Duquesne University), Mark Musolino, PhD (Rex Oakland and Software Engineering Institute), Mark Redfern, PhD (University of Pittsburgh), Michael Schubert, PhD (The Johns Hopkins University), Neil Shepard, PhD (Mayo Clinic), Jerry Slotkin, PhD (University of Delaware), Susan Whitney, PhD (University of Pittsburgh), Diane Wrisley, PhD, (Wingate University)

Expert Contributors-Taste

Susan Coldwell, PhD (University of Washington), chair. Linda Bartoshuk, PhD (University of Florida), Gary Beauchamp, PhD (Monell Chemical Senses Center), Paul Breslin, PhD (Rutgers University), Beverly Cowart, PhD (Monell Chemical Senses Center), Valerie Duffy, PhD (University of Connecticut), James Griffith, PhD (Northwestern University), Howard Hoffman, MA (NIH/National Institute on Deafness and Other Communication Disorders), Julie Mennella, PhD (Monell Chemical Senses Center), Marcia Pelchat, PhD (Monell Chemical Senses Center), Gregory Smutzer, PhD (Temple University)



Taste

Taste refers to the perception that arises from stimulation of taste receptors found most frequently on the tongue and throughout the oral cavity. This assessment uses a measure of taste sensitivity that examines the experience of tasting salty and bitter solutions on the tip of the tongue as well as in the whole mouth.

NIH Toolbox Taste Intensity Test



Expert Contributors-Pain

Winnie Dunn, PhD, OTR, FAOTA (University of Kansas), chair. Karon Cook, PhD (Northwestern University) Leeanne Carey, PhD, OTR (Florey Institute of Neuroscience and Mental Health) Lisa Connor, PhD (MGH Institute of Health Professions) Amy Darragh, PhD, OTR (Ohio State University) Brian Dudgeon, PhD, OTR, FAOTA (University of Alabama at Birmingham) Richard Gershon, PhD (Northwestern University) James Griffith, PhD (Northwestern University) Howard Hoffman, MA (NIH/National Institute on Deafness and Other Communication Disorders) Margo Holm, PhD, OTR, FAOTA (University of Pittsburgh) Partap Khalsa, DC, PhD (NIH/National Center for Complementary and Integrative Health) Joy MacDermid, PhD, OTR (McMaster University) Tracy Morrison, OTD, OTR (Arkansas State University) Deborah Olster, PhD (National Science Foundation) Linda Porter, PhD (NIH/National Institute of Neurological Disorders and Stroke) Dory Sabata, OTD, OTR (University of Kansas) Roseann SchAAF, PhD, OTR, FAOTA (Thomas Jefferson University) Jennifer Tanquary, PhD (University of Kansas Medical Center) David Victorson, PhD (Northwestern University)

Expert Contributors-Olfaction

Pamela Dalton, PhD (Monell Chemical Senses Center), chair. Richard Doty, PhD (University of Pennsylvania), Robert Frank, PhD (Ohio University), Howard Hoffman, MA (NIH/National Institute on Deafness and Other Communication Disorders), Julie Mennella, PhD (Monell Chemical Senses Center), Claire Murphy, PhD (San Diego State University), Jerry Slotkin, PhD (University of Delaware)

Scan the Sensation QR code for detailed features, equipment and materials requirements, current studies, papers, and presentations



Motor

Motor function involves complex physiological processes and requires the integration of multiple systems, including neuromuscular, musculoskeletal, cardiopulmonary, neural motor and sensory-perceptual systems. 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. Given its importance to overall neurological health and function, motor function was identified as a key domain for inclusion in the NIH Toolbox.

NIH Toolbox Motor Battery

This battery, recommended for ages 7+, consists of tests to assess Dexterity, Grip Strength, Standing Balance, Gait Speed and Endurance.

NIH Toolbox Early Childhood Motor Battery

This battery, recommended for ages 3-6, includes measures of Dexterity, Grip Strength, Standing Balance, and Endurance.

Dexterity

Dexterity is defined as an individual's ability to coordinate the fingers and manipulate objects in a timely manner. In order to assess dexterity, the **Nine-Hole-Peg Test** was selected. This test consists of a square board with nine holes and a container with nine wooden pegs. It is a time-monitored test in which pegs are picked up from the container one by one, put into the holes, and then returned.

Strength

Strength refers to the capacity of a muscle to produce the tension and power necessary for maintaining posture, initiating movement, or controlling movement during conditions of loading the musculoskeletal system. More simply, muscle strength is the magnitude of force generated by an isolated muscle or a muscle group. For measuring strength, the group chose a **grip dynamometer**. Several commercially available instruments have been validated in persons above the age of 4 years and have excellent inter-rater reliability. This instrument assesses upper extremity strength.



NIH Toolbox 9-Hole Pegboard Dexterity Test



NIH Toolbox Grip Strength Test



Balance

Balance refers to the ability to orient the body in space, maintain an upright posture under both static and dynamic conditions, and move and walk without falling. The ability to respond to internal and external disturbance, to realign body segments, as well as to protect oneself from falling is essential and inherent in everyday tasks.

NIH Toolbox Standing Balance Test



Endurance

Endurance is defined as the ability to sustain effort that requires conjoint work capacities from cardiopulmonary function, biomechanical and neuromuscular function. This measure focuses on overall physical fitness instead of individual muscle endurance. The **2-Minute Walk Test** was considered to be the best measure of endurance. This test measures the distance that a subject can walk, in normal speed, on a flat hard surface in a period of 2 minutes. In doing so, it evaluates the global and integrated responses of pulmonary, cardiovascular, and musculoskeletal systems.

NIH Toolbox 2-Minute Walk Endurance Test



Locomotion

Locomotion is defined as an act of moving from one place to the other place, reflecting ambulation ability including walking distance, velocity, and quality of the gait over different environments and ground surfaces. To assess locomotion, the NIH Toolbox **4-Meter Walk Gait Speed Test** was selected. In this assessment, participants are instructed to walk as quickly as possible at a pace he or she can maintain; time to complete the walk is recorded.

NIH Toolbox 4-Meter Walk Gait Speed Test



Expert Contributors-Motor

David Reuben, MD (University of California-Los Angeles) and W. Zev Rymer, MD, PhD (Rehabilitation Institute of Chicago and Northwestern University), co-chairs. Dallas Anderson, PhD (NIH/National Institute on Aging), Richard Bohannon, EdD, DPT (University of Connecticut), Deborah Bubela, PhD (University of Connecticut), Diane Damiano, PhD (NIH/NIH Clinical Center), Marjorie Garvey, MD (NIH/National Institute of Mental Health), Jin-Shei Lai, PhD (Northwestern University), Susan Magasi, PhD (University of Illinois at Chicago), Heather McCreath, PhD (University of California-Los Angeles), Rose Marie Rine, PhD (Specialty Therapy, LLC and Marshall University)

KEY:



Proctored tests require active administrator participation throughout the test.

Self-administered measures are completed independently by the subject but may still require proctor assistance at the beginning of the assessment to provide instructional or practice help.

Hands-on measures include some sort of activity typically including movement.

Tablet-administered measures involve active interaction with the tablet by the subject. (Note: All of the Toolbox measures have been designed for tablet-based data collection).

Scan the Motor QR code for detailed features, equipment and materials requirements, current studies, papers, and presentations



Emotion

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. Emotions can be positive or negative and distressing. Positive emotions can be reflections of well-being in our lives, and positive social relationships can buffer stress and enhance health. The NIH Toolbox Emotion domain includes four major subdomains, described below. Measures include both self-report and, for certain ages, parent-report versions.

NIH Toolbox Emotion Battery



This battery, recommended for ages 8+, consists of surveys of Positive Affect, General Life Satisfaction, Emotional Support, Friendship, Loneliness, Perceived Rejection, Perceived Hostility, Self-Efficacy, Sadness, Fear, and Anger. For ages 13+, the battery also includes surveys of Perceived Stress for 18+, surveys of Meaning and Purpose and Instrumental Support. In addition to scores for individual surveys, each emotion battery provides summary scores, which allow for general interpretation/evaluation of overall emotional health. Available summary scores (varies per age and battery) include: **Anxiety, Negative Affect, Negative Psychosocial Functioning, Negative Peer Relations, Social Satisfaction, Negative Social Perception and Psychological Well Being.**

NIH Toolbox Parent Report Emotion Battery



This battery, recommended for parents of children ages 3-12, includes measures of Positive Affect, General Life Satisfaction, Positive Peer Interaction, Social Withdrawal, Peer Rejection, Empathic Behaviors, Fear, Sadness and Anger. For those with children ages 3-7, surveys for Fear (Over Anxious and Separation Anxiety) are included. For those with children 8-12, surveys for Self-Efficacy and Perceived Stress are included.

Note: Emotion measures are generally delivered as fixed-length forms or computer-adaptive tests, presenting developmentally appropriate items by age band (typically 3-7, 8-12, 13-17 and 18+). Individual measures are administered in 1-2 minutes.

Psychological Well-Being

Psychological well-being includes both hedonic and eudaimonic aspects of well-being. Hedonic aspects are more subjective and experiential and emphasize pleasure and positive affect (e.g., happiness, serenity, and cognitive engagement). Eudaimonic well-being is more evaluative in nature and emphasizes fulfillment and purpose (e.g., meaning, life satisfaction). NIH Toolbox assesses three components of psychological well-being:

Positive Affect refers to feelings that reflect a level of pleasurable engagement with the environment, such as happiness, joy, excitement, enthusiasm, and contentment.

NIH Toolbox Positive Affect Survey

Life Satisfaction is one's cognitive evaluation of life experiences and is concerned with whether people like their lives or not.

NIH Toolbox General Life Satisfaction Survey

Meaning and Purpose is characterized by the extent to which people feel their lives matter or make sense.

NIH Toolbox Meaning and Purpose Survey

Stress and Self-Efficacy

Stress and Self-Efficacy focuses on individual perceptions about the nature of events and their relationship to the perceived coping resources of an individual. In general, psychological stress is said to occur when an individual perceives that environmental or internal demands that are personally meaningful exceed his/her adaptive capacity. NIH Toolbox assesses two areas related to stress and adaptive capacity:

Perceived Stress is defined by individual perceptions about the nature of events and their relationship to the values and coping resources of an individual.

NIH Toolbox Perceived Stress Survey

Self-Efficacy can be described as a person's belief in his/her capacity to manage functioning and have control over meaningful events.

NIH Toolbox Self-Efficacy Survey

Social Relationships

There are several dimensions of social relationships, including their structure, extent and quality. NIH Toolbox focuses on four aspects of social relationships:

Perceived Social Support is the extent to which an individual views his/her social relationships as available to provide aid in times of need or when problems arise. It includes instrumental and emotional types of perceived social support. Emotional Support refers to the perception that people in one's social network are available to listen to one's problems with empathy, caring and understanding. Instrumental Support refers to the perception that people in one's social network are available to provide material or functional aid in completing daily tasks, if needed.

NIH Toolbox Emotional Support Survey

NIH Toolbox Instrumental Support Survey

Companionship is characterized by self-reported perceptions of the availability of friends or companions with whom to interact or affiliate (i.e., friendship) and perceptions that one is alone, lonely or socially isolated from others (i.e., loneliness).

IH Toolbox Friendship Survey

NIH Toolbox Loneliness Survey

NIH Toolbox Social Withdrawal Survey

NIH Toolbox Positive Peer Interaction Survey

Social Distress is the extent to which an individual perceives his/her daily social interactions as negative or distressing. This can include aspects of perceived hostility (e.g., how often people argue with me, yell at me, or criticize me) and perceived insensitivity (e.g., how often people don't listen when I ask for help, or don't pay attention to me).

NIH Toolbox Perceived Rejection Survey

NIH Toolbox Perceived Hostility Survey

NIH Toolbox Peer Rejection Survey

Positive Social Development is characterized by parents' evaluation of their children's empathic behaviors. It is an indicator of a child's current emotional health and a predictor of positive and supportive social relationships in adolescence and adulthood.

NIH Toolbox Empathic Behaviors Survey

Negative Affect

Negative Affect refers to unpleasant feelings or emotions that exist on a continuum ranging from common and normal feelings of sadness, fear, and anger to more extreme feelings along the same continuum. NIH Toolbox focuses on three major components of Negative Affect:



Anger is characterized by attitudes of hostility and cynicism, often associated with experiences of frustration impeding goal-directed behavior.

NIH Toolbox Anger-Affect Survey

NIH Toolbox Anger-Hostility Survey

NIH Toolbox Anger-Physical Aggression Survey

NIH Toolbox Anger Survey

Fear is best characterized by symptoms of anxiety that reflect autonomic arousal and perceptions of threat.

NIH Toolbox Fear-Affect Survey

NIH Toolbox Fear-Somatic Arousal Survey

NIH Toolbox Fear-Over Anxious Survey

NIH Toolbox Fear Survey

NIH Toolbox Separation Anxiety Survey

Sadness is distinguished by low levels of positive affect and comprised of symptoms that are primarily affective (poor mood) and cognitive (negative perceptions of self, the world, and the future) indicators of depression.

NIH Toolbox Sadness Survey

Supplemental Measures

NIH Toolbox Apathy Survey (Age 18+)

NIH Toolbox Domain-Specific Life Satisfaction Survey (Age 8+ and Parent report)

NIH Toolbox Emotion Control Survey (Parent Report ages 8-12)

NIH Toolbox Maternal Relationship Survey (Ages 8-17)

NIH Toolbox Paternal Relationship Survey (Ages 8-17)

NIH Toolbox Positive Parent Relationship Survey (Parent Report Ages 3-12)

NIH Toolbox Negative Parent Relationship Survey (Parent Report Ages 3-12)

NIH TB Sibling Rejection Survey (Parent Report Ages 3-12)

Many of the emotion measures are available in alternate formats (such as also offering a fixed-length form when a computer-adaptive test is contained in the main battery).

KEY:



age range



test time



self-administered



tablet-administered

Expert Contributors-Emotion

David Cella, PhD (Northwestern University) and Paul Pilkonis, PhD (University of Pittsburgh), co-chairs.
Rita Bode, PhD (Rehabilitation Institute of Chicago and Northwestern University), Pim Brouwers, PhD (NIH/National Institute of Mental Health), Zeeshan Butt, PhD (Northwestern University) Seung Choi, PhD (Northwestern University), Jill Cyranowski, PhD (University of Pittsburgh), Hugh Hendrie, MB, ChB, DSc (Indiana University), Sarah Knox, PhD (University of West Virginia), Mary Jo Kupst, PhD (Medical College of Wisconsin), Jin-Shei Lai, PhD (Northwestern University), Tara Moore, MA, MPH (University of Pittsburgh), Cindy Nowinski, MD, PhD (Northwestern University), John Salsman, PhD (Wake Forest School of Medicine), Catherine Stony, PhD (NIH/ National Heart, Blood and Lung Institute), Gitanjali Taneja, PhD (NIH)/National Institute of Environmental Health Science), Nicholas Zill, PhD (Child Trends)

Scan the Emotion QR code for detailed features, equipment and materials requirements, current studies, papers, and presentations





For Assessment of Neurological and Behavioral Function®
www.nihtoolbox.org help@nihtoolbox.org

Contact Information

Principal Investigator
Richard C. Gershon, PhD
Vice-Chair for Research, Department of Medical Social Sciences
Feinberg School of Medicine
Northwestern University
gershon@northwestern.edu

Lead Project Officer
Molly V. Wagster, PhD
Chief, Behavioral and Systems Neuroscience Branch
Division of Neuroscience
National Institute on Aging/National Institutes of Health
wagsterm@nia.nih.gov

The **NIH Toolbox iPad® app** provides access to all of the NIH Toolbox measures, as well as the Patient-Reported Outcomes Measurement Information System (PROMIS®), Neuro-QoL (Quality of Life in Neurological Disorders) and many other NIH sponsored measurement systems. It enables automatic scoring, several options for data export and access to user support.



Other options for administration of NIH Toolbox Emotion measures can be found on the HealthMeasures website www.healthmeasures.net. HealthMeasures is a scientific and technical resource supporting expansion and use of four state-of-the-science measurement systems: PROMIS, NIH Toolbox, Neuro-QoL, and ASCQ-MeSM.



Sponsors

Primary support was provided through the NIH Blueprint for Neuroscience Research, with additional support from the NIH Office of Behavioral and Social Sciences Research and the National Children's Study.

Member Institutes, Centers and Offices

National Center for Complementary and Integrative Health (NCCIH)
National Eye Institute (NEI)
National Institute on Aging (NIA)
National Institute on Alcohol Abuse and Alcoholism (NIAAA)
National Institute of Biomedical Imaging and Bioengineering (NIBIB)
Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)
National Institute on Drug Abuse (NIDA)

National Institute on Deafness and Other Communication Disorders (NIDCD)
National Institute of Dental and Craniofacial Research (NIDCR)
National Institute of Environmental Health Sciences (NIEHS)
National Institute of General Medical Sciences (NIGMS)
National Institute of Mental Health (NIMH)
National Institute of Neurological Disorders and Stroke (NINDS)
National Institute of Nursing Research (NINR)
Office of Behavioral and Social Sciences Research (OBSSR)

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.



© 2017 National Institutes of Health and Northwestern University.

NIH Toolbox, NIH Toolbox for the Assessment of Neurological and Behavioral Function, the NIH Toolbox logo, PROMIS, Patient-Reported Outcomes Measurement Information System, the PROMIS logo, ASCQ-Me, Adult Sickle Cell Quality of Life Measurement Information System, and the ASCQ-Me logo are marks owned by the U. S. Department of Health and Human Services.