



NIH Toolbox

Assessment of Neurological and Behavioral Function

EMOTION

Sensation

Cognition

MOTOR

Filling the NIH Toolbox: Defining Priorities and Selecting Measures for a Uniform Assessment Battery of Neurological and Behavioral Function

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The NIH Toolbox - Background



- ◆ The lack of uniformity of outcomes measures used in health research makes it difficult to compare findings across studies, settings and populations.
- ◆ Inconsistent use of measures makes it difficult to track population health across the life span.
- ◆ NIH Blueprint on Neuroscience research seeks to optimize NIH-funded research by enhancing collaboration among 15 NIH institutes and centers (ICs) that support research on the nervous system.
- ◆ Pooling resources and expertise, the Blueprint confronts challenges that transcend any single institute or center and serves the entire neuroscience community.

NIH Toolbox – Background



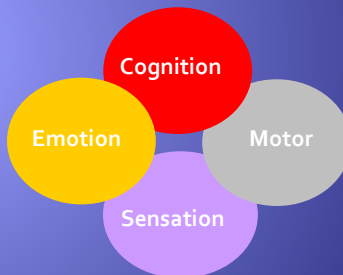
- ◆ The NIH Toolbox is a 5-year contract designed to develop a standard set of assessments for neurological function.
- ◆ Represents the collaborative funding of the 15 NIH institutes and involves collaboration of over 200 scientists from around the United States. (A number of whom are here at ACRM this week)

Collaborating Agencies within the NIH



National Institute on Aging (NIA)
National Institute on Mental Health (NIMH)
National Institute on Drug Abuse (NIDA)
National Institute on Neurological Disorders & Stroke (NINDS)
National Institute on Environmental Health Sciences (NIEHS)
National Institute on Deafness and Other Communicative Disorders (NIDCD)
National Eye Institute (NEI)
National Institute on Child Health and Human Development (NICHD)
National Institute of Nursing Research (NINR)
National Institute on General Medical Sciences (NIGMS)
Office of Behavioral and Social Sciences Research (OBSSR)
National Center on Complementary and Alternative Medicine (NCCAM)
National Institute on Alcohol Abuse and Alcoholism (NIAAA)
National Center on Research Resources (NCRR)

NIH Toolbox for Assessment of Neurological and Behavioral Function



- ◆ Valid and reliable
- ◆ Multidimensional
- ◆ Versatile but brief
- ◆ Diverse
- ◆ State-of-the-art
- ◆ Dynamic



Purpose of the NIH Toolbox



What it is:

- ◆ Brief unified set of measures
- ◆ Use in large longitudinal, epidemiological, clinical trials
- ◆ Measures the same constructs over lifespan
- ◆ Where possible, objective measures over self-report

What it is not:

- ◆ Not a diagnostic tool
- ◆ Not conceptualized to substitute for the in-depth assessment of a domain or sub-domain



Conducted in Two Phases



- Phase I (2 years) – ID of content area, expert interviews, research on instrumentation, development of draft instruments
- Phase II (3 years) – Field testing, refinement, norming, delivery of final product and procedure manual



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Toolbox Development



- ◆ Established rich collaborative network
 - 242 named personnel
 - 126 consultants
 - 19 subcontracts
- ◆ Conducted two expert Requests for Information (N=290)
 - Nominate and rank sub-domains and constructs
 - Determine instrument cost and time constraints
- ◆ Conducted literature review
- ◆ Held over 500 team meetings to date

Test Selection Process



- ◆ Candidate measures (Toolbox Library = 1,391) generated from literature review and expert input (requests for information, interviews, team meetings)
- ◆ Measures systematically reviewed

Selection Criteria



- ◆ Applicable across the age span – ages 3 - 85
- ◆ No intellectual property concerns
- ◆ Psychometrically sound
- ◆ Brief, easy to use
- ◆ Applicable in variety of settings and with different subgroups
- ◆ Preference for instruments already validated and normed for ages 3 - 85

Results of these Activities



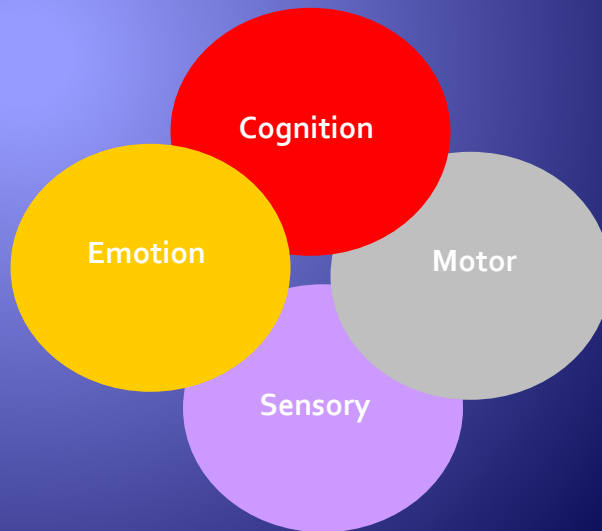
- ◆ Instrument recommendations for 54 constructs
- ◆ Draft development plans established for 61 different measures

The Process Continues. . .



- ◆ Instrument development
- ◆ Pre-testing and piloting of new items and instruments
- ◆ Concurrent validation of new instruments with industry "Gold Standards"
- ◆ Selection of final instruments for norming
- ◆ Norming of all Toolbox instruments in a national random sample (English & Spanish)

Toolbox Domains



Cognition



Executive Function

*Inhibitory Control
Cognitive Flexibility*

Episodic Memory

*Visual
Auditory*

Language

*Picture Vocabulary
Reading Decoding*

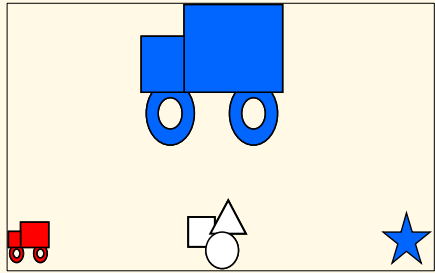
Working Memory

Attention

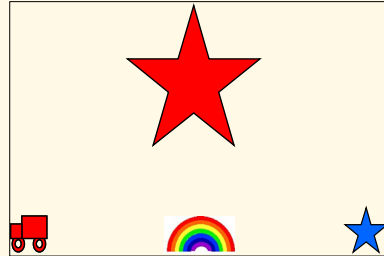
Processing Speed

Dimensional Change Card Sort

P. Zelazo, Nature Protocols, 2006

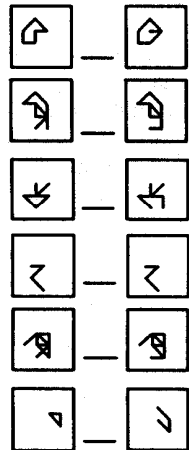


Shape Trial



Color Trial

Pattern Comparison



Letter Comparison

HFZQXVRY S ___ HFZQXVRY S
 LZY ___ LX Y
 CLNPZD ___ CLNPZD
 HCF ___ RCF
 MRPBFS ___ MRPBFS
 ZQJKHTBVW ___ ZGJKHTBVW



Person is instructed to classify the pairs as Same (S) or Different (D) as quickly as possible
 (Salthouse, 1991)

Pattern Comparison



Motor



Endurance

Locomotion

Strength

Dexterity

Balance

*Upper Extremity
Lower Extremity*

(Non-vestibular)

Motor Measures and Progress to Date Dexterity Horse Race



- ◆ Candidate Measures
 - 9-hole pegboard
 - Electronic 9-hole pegboard
 - 25-hole pegboard
 - Grooved 25-hole pegboard
- ◆ Validation Measure
 - Purdue pegboard (adults)
 - Bruninicks-Osteretsky (peds)

Pre-testing Results

- ◆ Emerging Leader
 - ◆ Ability to Discriminate
- Unique contributions and additional development
- ◆ Standardized administration
 - ◆ Computerized data capture



Motor Progress to Date Strength Horserace



Instruments

- Grip strength dynamometry
- Electronic muscle testing
- Timed chair rise

Validation Measures

- Biodex (adults)
- Bruinicks Oseretski (peds)

Preliminary findings

- Grip strength leading candidate for U/E
- L/E continues to be problematic
- Electronic muscle testing relies on tester's ability to provide counter-pressure
- Timed chair rise not pure measure of strength, includes balance and endurance

Motor Measure & Progress to Date Locomotion, Endurance, and Balance



Locomotion

- 4 m walk
- 20 ft walk (10 ft out and back)
- 20 ft walk

Endurance

- 6 minute walk test (100 ft course)
- 6 minute walk test (50 ft course)
- 2 minute walk test (50 ft course)

Balance

- Development efforts combined with vestibular balance (part of sensory team under direction of Dr. Susan Whitney).

Sensation



Taste

*Preference Intensity
Bitter Perception
PROP Sensitivity*

Olfaction

*Odor Identification
Olfactory Sensitivity*

Vestibular Balance

*Vestibularocular Reflex
Vestibulospinal Function
Central Involvement*

Audition

*Auditory Processing
Hearing Loss
Hearing Threshold
Middle Ear Function*

Somatosensation

*Pain
Proprioception
Temperature
Texture
Sensory Feedback*

Vision

*Visual Acuity Function
Visual Function HRQL
Peripheral Vision*



Emotion

Positive Affect

*Happiness
Life Satisfaction
Well-Being*

Negative Affect

*Sadness
Fear
Anger
General Distress
Apathy*

Stress and Coping

*Perceived Stress
Coping Strategy
Coping Self-efficacy*

Social Relationships

*Social Support
Social Network
Integration
Loneliness*

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Implication for Rehabilitation Research



- ◆ The Toolbox will become the industry standard for measuring neurological function in the general population – including NIH funded research.
- ◆ Unified language of measurement across key domains of performance
- ◆ Enable baseline comparisons after onset of neuro-functional changes.
- ◆ Enhanced ability to compare results across studies, samples and populations.

Opportunities for Rehabilitation Research



- Opportunity to validate and norm with clinical populations.
- Ability to link outcomes in clinical samples with the general population.
 - e.g. to document disparities
- Ability to use extensive normative data to ask interesting questions.

How to Keep up to Date with the NIH Toolbox



- ◆ Web site – www.nihtoolbox.org
- ◆ Quarterly newsletter
 - 400 copies distributed
 - Available on the website
- ◆ Public meeting October 27, 2008
 - Bethesda North Marriott Hotel & Conference Center





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