

NIH Toolbox



Technical Manual

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NIH Toolbox Technical Manual

Domain:

COGNITION

Subdomain:

LANGUAGE

Measure:

NIH Toolbox Picture Vocabulary Test

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This Technical Manual contains the following informational sections:

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Section 1: Introduction to NIH Toolbox

NIH Toolbox is a multidimensional set of brief measures assessing cognitive, emotional, motor, and sensory function from ages 3-85. This suite of on-line and royalty-free measures can be administered to study participants 3 to 85 years of age in two hours or less, across diverse study designs and settings.

What is the NIH Toolbox?

The NIH Toolbox provides a standard set of royalty-free, brief, and comprehensive assessment tools that can be used by researchers and clinicians in a variety of settings, with a particular emphasis on measuring outcomes in longitudinal epidemiologic studies and prevention or intervention trials across the lifespan (ages 3-85). The battery ensures that assessment methods and results can be used for comparisons across existing and future studies and provides a “common currency” for the study of neurological research that promotes economies of scale and enhanced efficiency in measurement. The NIH Toolbox can be used to monitor neurological and behavioral function over time and measure key constructs across developmental stages. This facilitates the study of functional changes across the lifespan, including evaluating intervention and treatment effectiveness.

The NIH Toolbox Batteries

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

Selection of the NIH Toolbox Domains and Subdomains

Four domains were selected for the NIH Toolbox: Cognition, Emotion, Motor, and Sensation. Subdomain selection was based upon literature reviews, expert interviews, and multiple formal Requests for Information (RFI) of NIH-funded researchers. Initial literature and database reviews and an RFI identified the subdomains 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 subdomains along with the criteria affecting 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 subdomains. A second consensus group meeting was held and results directed the decision for the final NIH Toolbox to assess four core domain areas (cognitive, emotional, motor, and sensory health and function).

Selection of Measures for the NIH Toolbox

More than 1,400 existing measures were identified and evaluated for potential 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. There was also a preference for instruments that were already validated and normed for use with individuals between 3 and 85 years old. Results of the instrument selection process yielded draft development plans established for the NIH Toolbox measures.

Early Childhood Use

NIH Toolbox measure development focused special attention on assessing young children, to ensure that all tests given are developmentally appropriate for ages 3-7. A special team of early childhood 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 to ensure they fit the needs of young children. Advanced statistical methods were used to emphasize continuity of measurement, allowing Toolbox users to confidently conduct longitudinal measurement from age 3 through the life span while assessing the same domain constructs.

Section 2: Validation

Validation studies were conducted for all NIH Toolbox Cognition domain measures, to assure that these important tools for research met rigorous psychometric standards. Studies were

conducted across the entire age range and were statistically compared against “gold standard” measures wherever available.

For specifics regarding Cognition domain measure validation, see Weintraub et al., Cognition Assessment Using the NIH Toolbox, *Neurology*, in press. This manuscript describes measure development studies undertaken (e.g., expert panels for content development and validation; cognitive interviews; small and large-scale pilot testing) and psychometric characteristics (e.g., internal consistency and test-retest reliability; convergent and divergent validity).

Section 3: 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, ethnicity, race, and socioeconomic status – was administered all of the NIH Toolbox measures at sites around the country (n = 2,917 English-speaking children, ages 3-17; n = 496 Spanish-speaking children, ages 3-7; n = 1,038 English-speaking adults, ages 18-85; n = 408 Spanish-speaking adults, ages 18-85). NIH Toolbox normative scores are now available for each year of age from 3 through 17, as well as for age ranges 18-29, 30-39, 40-49, 50-59, 60-69, and 70-85, allowing for targeted and accurate comparisons to the U.S. population.

Specifics regarding NIH Toolbox norming sampling methods (e.g., stratification by age, gender, and language preference; sampling a minimum of 25-100 individuals per targeted demographic and language subgroup) and norming analytic methods (e.g., post-stratification adjustment using iterative proportional fitting, i.e., “raking”) can be found in the following publication: Beaumont et al., Norming Plans for the NIH Toolbox, *Neurology*, in press.

Section 4: NIH Toolbox and the National Children’s Study (NCS)

In collaboration with NIH Toolbox scientists, NCS investigators selected measures from PROMIS and NIH Toolbox for a Maternal Health Profile, the Maternal Self-Reported Health Battery. This profile assesses Physical Health (Physical function, Fatigue, Sleep disturbance, Sleep-related impairment), Mental Health (Anger, Anxiety, Depression, Positive affect, Perceived stress, Self-efficacy), and Social Health (Social support and companionship, Social isolation). The Maternal Self-Reported Health Battery was field tested in fall 2011, using an online sample of 1000 women (200 pre-conception, 150 pregnant women (50 per trimester), and 650 mothers with a child between 0-36 months of age). In addition, NIH Toolbox norming was jointly sponsored by the NCS and included: 3,413 children in single-year age bands (from 3-17 years); 1,446 adults in seven age bands, including the mothers of children also being tested; and 105 pregnant women. The NIH Toolbox sampling plan matched distributions of race/ethnicity and level of education for each age band.

Section 5: Domain Definition

Domain: COGNITION

Cognition refers to the mental processes involved in gaining knowledge and comprehension. It includes processes 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 when the target of the study is not cognition itself. The Cognition domain includes measures of:

EXECUTIVE FUNCTION

Measured by:

NIH Toolbox Flanker Inhibitory Control and Attention Test

NIH Toolbox Dimensional Change Card Sort Test

ATTENTION

Measured by:

NIH Toolbox Flanker Inhibitory Control and Attention Test

EPISODIC MEMORY

Measured by:

NIH Toolbox Picture Sequence Memory Test

NIH Toolbox Auditory Verbal Learning Test (Rey) (Supplemental Measure)

LANGUAGE

Measured by:

NIH Toolbox Picture Vocabulary Test

NIH Toolbox Oral Reading Recognition Test

PROCESSING SPEED

Measured by:

NIH Toolbox Pattern Comparison Processing Speed Test

NIH Toolbox Oral Symbol Digit Test (Supplemental Measure)

WORKING MEMORY

Measured by:

NIH Toolbox List Sorting Working Memory Test

Section 6: Subdomain Definition

Subdomain: LANGUAGE

Language refers to a set of mental processes that translate thought into symbols (e.g., words, gestures) that can be shared among individuals for purposes of communication. NIH Toolbox focuses on two aspects of language. The first is receptive word knowledge, which is fundamental to learning and 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. In NIH Toolbox, Language is measured by:

NIH Toolbox Picture Vocabulary Test

NIH Toolbox Oral Reading Recognition Test

Section 7: Measure Description

COGNITION Core Measure

The NIH Toolbox Picture Vocabulary Test, a measure of receptive vocabulary, is administered in a computerized adaptive format – that is, after responding to the first question, the next

question a participant receives depends on his/her response to the previous question. This approach tailors the assessment to individual participants' needs. The respondent is presented with an audio recording of a word and four photographic images on the computer screen and is asked to select the picture that most closely matches the meaning of the word. The test takes approximately four minutes to administer and is recommended for ages 3-85.

Section 8: Post-Validation/Post-Norming Changes to the Measure

In addition to those changes previously reported on during the measure's development and validation phases (Weintraub et al., Cognition Assessment Using the NIH Toolbox, *Neurology*, in press), the following changes have been made to this measure:

Item exclusions: Based on follow-up psychometric evaluations, an additional 60 English-version and 131 Spanish-version items were excluded (English-version item bank reduced from 402 to 342 items; Spanish-version item bank reduced from 389 to 258 items).

Test administration changes: The test was changed from a 25-item fixed-length computer-adaptive test (CAT) to a variable-length CAT with 20-30 items.

Items are administered adaptively until a respondent has answered 20-30 items.

Item-level parameter changes: Item calibrations (English and Spanish) were updated based on the norming sample. The following item-selection rule for the computer adaptive test was chosen for all age groups: Select an item in the bank that the respondent has the probability=0.50 of a correct answer (given the current estimate of his/her ability level).

Section 9: The Measure's Scoring Model

Measurement theory applied for scoring:

Rasch/Item Response Theory (IRT)

Rasch/IRT model employed:

Rasch Dichotomous Model

Measure length:

Variable (computer-adaptive test: maximum 30 items)

Response data:

Dichotomous (correct, incorrect)

Scores computed/available*:

Rasch/IRT Theta Score

Age-Adjusted Scale Score (mean=100, standard deviation=15)

Fully Adjusted Scale Score (mean=100, standard deviation=15)

Unadjusted Scale Score (mean=100, standard deviation=15)

National Percentile Rank (corresponds to the Age-Adjusted Scale Score)

Computed Score (converted from Theta score; range from 200 to 2000)

*Details on these scores and their interpretations are available in the NIH Toolbox Scoring and Interpretation Guide.

Section 10: Measure Norms-English

The following Tables and Figure present NIH Toolbox normative data associated with this measure:

Table 1. Measure Raw/Computed Score, Unadjusted Scale Score, and Fully Adjusted Scale Score Summary (N, Mean, Standard Deviation) by Age Group (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

Table 2. Measure Raw/Computed Score Statistics (N, Mean, Standard Deviation, Minimum/Maximum Observed, 25th/50th/75th Percentile) per Age Group (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

Figure 1. Measure Mean Unadjusted Scale Scores across All Age Groups (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85)

Table 1. NIH Toolbox Picture Vocabulary Test-English by Age Group	Picture Vocabulary Test-English (theta)			Vocabulary - English Unadjusted Scale Score			Vocabulary - English Fully Adjusted Scale Score		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Age Group									
3	100	-2.63	0.78	100	71.80	5.11	96	100.19	12.22
4	103	-2.01	0.66	103	75.90	4.53	99	100.35	10.20
5	107	-1.35	0.51	107	80.56	3.52	102	100.00	8.71
6	92	-0.80	0.64	92	84.43	4.35	86	99.99	8.86
7	108	-0.56	0.44	108	86.09	3.03	104	99.59	7.04
8	159	-0.25	0.45	159	88.21	3.10	152	99.74	7.35
9	165	0.41	0.43	165	92.78	3.03	154	99.61	6.77
10	174	0.63	0.42	174	94.34	2.95	165	99.54	6.41
11	173	1.10	0.49	173	97.69	3.53	164	99.77	7.80
12	179	1.38	0.53	179	99.78	4.02	171	99.64	7.92
13	173	1.69	0.57	173	102.07	4.33	166	100.09	8.03
14	177	1.97	0.52	177	104.27	4.11	171	99.81	7.69
15	178	2.14	0.59	178	105.68	4.78	174	99.79	8.71
16	170	2.40	0.65	170	107.89	5.35	162	99.78	9.13
17	167	2.33	0.58	167	107.18	4.75	161	99.59	8.73
18 - 29	162	2.71	2.44	162	110.49	20.07	159	100.02	31.89
30 - 39	200	3.11	2.09	200	114.08	17.75	193	100.20	27.02
40 - 49	160	3.23	1.95	160	115.03	17.86	153	99.82	27.72
50 - 59	131	3.26	2.49	131	115.44	22.57	121	99.84	33.64
60 - 69	107	3.48	2.71	107	117.63	24.53	106	100.58	36.65
70 - 85	130	3.21	1.98	130	115.30	17.29	123	100.75	24.92
All	3115	2.61	1.89	3115	110.26	15.37	2982	100.06	17.53

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 3		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	53	47	100	0	0	0	53	47	100
	Mean	-2.63	-2.63	-2.63				-2.63	-2.63	-2.63
	Standard Deviation	0.96	0.52	0.78				0.96	0.52	0.78
	Minimum Observed	-5.95	-4.99	-5.95				-5.95	-4.99	-5.95
	25th Percentile	-3.42	-3.09	-3.18				-3.42	-3.09	-3.18
	50th Percentile (Median)	-2.46	-2.47	-2.46				-2.46	-2.47	-2.46
	75th Percentile	-1.84	-2.03	-1.97				-1.84	-2.03	-1.97
	Maximum Observed	1.03	-1.23	1.03				1.03	-1.23	1.03

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 4		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	53	50	103	0	0	0	53	50	103
	Mean	-1.97	-2.09	-2.01				-1.97	-2.09	-2.01
	Standard Deviation	0.67	0.66	0.66				0.67	0.66	0.66
	Minimum Observed	-4.26	-6.15	-6.15				-4.26	-6.15	-6.15
	25th Percentile	-2.46	-2.36	-2.46				-2.46	-2.36	-2.46
	50th Percentile (Median)	-2.06	-2.01	-2.06				-2.06	-2.01	-2.06
	75th Percentile	-1.44	-1.33	-1.41				-1.44	-1.33	-1.41
	Maximum Observed	0.40	-0.59	0.40				0.40	-0.59	0.40

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 5		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	51	56	107	0	0	0	51	56	107
	Mean	-1.32	-1.39	-1.35				-1.32	-1.39	-1.35
	Standard Deviation	0.52	0.50	0.51				0.52	0.50	0.51
	Minimum Observed	-3.63	-5.77	-5.77				-3.63	-5.77	-5.77
	25th Percentile	-1.67	-1.91	-1.77				-1.67	-1.91	-1.77
	50th Percentile (Median)	-1.32	-1.35	-1.32				-1.32	-1.35	-1.32
	75th Percentile	-0.84	-0.97	-0.96				-0.84	-0.97	-0.96
	Maximum Observed	0.38	1.52	1.52				0.38	1.52	1.52

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 6		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	42	50	92	0	0	0	42	50	92
	Mean	-0.74	-0.87	-0.80				-0.74	-0.87	-0.80
	Standard Deviation	0.85	0.41	0.64				0.85	0.41	0.64
	Minimum Observed	-6.08	-2.56	-6.08				-6.08	-2.56	-6.08
	25th Percentile	-1.14	-1.25	-1.14				-1.14	-1.25	-1.14
	50th Percentile (Median)	-0.58	-0.84	-0.73				-0.58	-0.84	-0.73
	75th Percentile	-0.15	-0.36	-0.21				-0.15	-0.36	-0.21
	Maximum Observed	1.71	0.61	1.71				1.71	0.61	1.71

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 7		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	55	53	108	0	0	0	55	53	108
	Mean	-0.55	-0.57	-0.56				-0.55	-0.57	-0.56
	Standard Deviation	0.53	0.33	0.44				0.53	0.33	0.44
	Minimum Observed	-4.80	-2.18	-4.80				-4.80	-2.18	-4.80
	25th Percentile	-0.87	-0.93	-0.87				-0.87	-0.93	-0.87
	50th Percentile (Median)	-0.45	-0.58	-0.51				-0.45	-0.58	-0.51
	75th Percentile	-0.18	-0.15	-0.18				-0.18	-0.15	-0.18
	Maximum Observed	1.94	0.77	1.94				1.94	0.77	1.94

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 8		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	83	76	159	0	0	0	83	76	159
	Mean	-0.36	-0.09	-0.25				-0.36	-0.09	-0.25
	Standard Deviation	0.51	0.34	0.45				0.51	0.34	0.45
	Minimum Observed	-3.26	-2.18	-3.26				-3.26	-2.18	-3.26
	25th Percentile	-0.70	-0.52	-0.67				-0.70	-0.52	-0.67
	50th Percentile (Median)	-0.38	-0.14	-0.30				-0.38	-0.14	-0.30
	75th Percentile	0.17	0.32	0.25				0.17	0.32	0.25
	Maximum Observed	1.80	1.75	1.80				1.80	1.75	1.80

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 9		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	82	83	165	0	0	0	82	83	165
	Mean	0.37	0.46	0.41				0.37	0.46	0.41
	Standard Deviation	0.48	0.39	0.43				0.48	0.39	0.43
	Minimum Observed	-1.04	-3.85	-3.85				-1.04	-3.85	-3.85
	25th Percentile	-0.16	-0.01	-0.09				-0.16	-0.01	-0.09
	50th Percentile (Median)	0.28	0.41	0.29				0.28	0.41	0.29
	75th Percentile	0.88	0.89	0.88				0.88	0.89	0.88
	Maximum Observed	2.78	2.19	2.78				2.78	2.19	2.78

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 10		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	84	90	174	0	0	0	84	90	174
	Mean	0.72	0.50	0.63				0.72	0.50	0.63
	Standard Deviation	0.50	0.33	0.42				0.50	0.33	0.42
	Minimum Observed	-2.65	-1.75	-2.65				-2.65	-1.75	-2.65
	25th Percentile	0.14	0.11	0.11				0.14	0.11	0.11
	50th Percentile (Median)	0.63	0.42	0.57				0.63	0.42	0.57
	75th Percentile	1.25	1.01	1.22				1.25	1.01	1.22
	Maximum Observed	2.80	1.89	2.80				2.80	1.89	2.80

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 11		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	88	85	173	0	0	0	88	85	173
	Mean	1.05	1.18	1.10				1.05	1.18	1.10
	Standard Deviation	0.55	0.42	0.49				0.55	0.42	0.49
	Minimum Observed	-1.40	-1.23	-1.40				-1.40	-1.23	-1.40
	25th Percentile	0.45	0.46	0.45				0.45	0.46	0.45
	50th Percentile (Median)	1.04	1.27	1.13				1.04	1.27	1.13
	75th Percentile	1.75	1.81	1.75				1.75	1.81	1.75
	Maximum Observed	3.58	2.73	3.58				3.58	2.73	3.58

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 12		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	82	97	179	0	0	0	82	97	179
	Mean	1.22	1.58	1.38				1.22	1.58	1.38
	Standard Deviation	0.56	0.50	0.53				0.56	0.50	0.53
	Minimum Observed	-1.39	-1.15	-1.39				-1.39	-1.15	-1.39
	25th Percentile	0.73	1.01	0.80				0.73	1.01	0.80
	50th Percentile (Median)	1.23	1.55	1.31				1.23	1.55	1.31
	75th Percentile	1.80	2.14	2.01				1.80	2.14	2.01
	Maximum Observed	3.55	4.08	4.08				3.55	4.08	4.08

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 13		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	100	73	173	0	0	0	100	73	173
	Mean	1.80	1.45	1.69				1.80	1.45	1.69
	Standard Deviation	0.62	0.48	0.57				0.62	0.48	0.57
	Minimum Observed	-3.09	-2.25	-3.09				-3.09	-2.25	-3.09
	25th Percentile	1.22	1.08	1.14				1.22	1.08	1.14
	50th Percentile (Median)	1.89	1.46	1.74				1.89	1.46	1.74
	75th Percentile	2.36	2.13	2.31				2.36	2.13	2.31
	Maximum Observed	3.88	3.29	3.88				3.88	3.29	3.88

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 14		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	91	86	177	0	0	0	91	86	177
	Mean	2.04	1.87	1.97				2.04	1.87	1.97
	Standard Deviation	0.54	0.50	0.52				0.54	0.50	0.52
	Minimum Observed	-0.44	-4.15	-4.15				-0.44	-4.15	-4.15
	25th Percentile	1.25	1.55	1.37				1.25	1.55	1.37
	50th Percentile (Median)	2.08	1.91	2.01				2.08	1.91	2.01
	75th Percentile	2.65	2.44	2.57				2.65	2.44	2.57
	Maximum Observed	4.33	3.81	4.33				4.33	3.81	4.33

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 15		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	84	94	178	0	0	0	84	94	178
	Mean	2.19	2.07	2.14				2.19	2.07	2.14
	Standard Deviation	0.70	0.48	0.59				0.70	0.48	0.59
	Minimum Observed	-1.42	-0.00	-1.42				-1.42	-0.00	-1.42
	25th Percentile	1.34	1.42	1.38				1.34	1.42	1.38
	50th Percentile (Median)	2.27	2.04	2.17				2.27	2.04	2.17
	75th Percentile	3.11	2.70	2.96				3.11	2.70	2.96
	Maximum Observed	4.81	5.00	5.00				4.81	5.00	5.00

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 16		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	81	89	170	0	0	0	81	89	170
	Mean	2.61	2.13	2.40				2.61	2.13	2.40
	Standard Deviation	0.71	0.57	0.65				0.71	0.57	0.65
	Minimum Observed	-0.59	-0.68	-0.68				-0.59	-0.68	-0.68
	25th Percentile	1.94	1.46	1.74				1.94	1.46	1.74
	50th Percentile (Median)	2.51	2.18	2.37				2.51	2.18	2.37
	75th Percentile	3.32	2.81	3.19				3.32	2.81	3.19
	Maximum Observed	5.05	4.38	5.05				5.05	4.38	5.05

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 17		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	88	79	167	0	0	0	88	79	167
	Mean	2.42	2.16	2.33				2.42	2.16	2.33
	Standard Deviation	0.63	0.51	0.58				0.63	0.51	0.58
	Minimum Observed	-2.10	-1.28	-2.10				-2.10	-1.28	-2.10
	25th Percentile	1.86	1.56	1.79				1.86	1.56	1.79
	50th Percentile (Median)	2.24	2.09	2.24				2.24	2.09	2.24
	75th Percentile	3.07	2.96	3.02				3.07	2.96	3.02
	Maximum Observed	4.39	4.30	4.39				4.39	4.30	4.39

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 18-29		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	54	108	162	0	0	0	54	108	162
	Mean	2.85	2.59	2.71				2.85	2.59	2.71
	Standard Deviation	2.80	2.23	2.44				2.80	2.23	2.44
	Minimum Observed	-4.33	-1.94	-4.33				-4.33	-1.94	-4.33
	25th Percentile	2.17	1.92	2.04				2.17	1.92	2.04
	50th Percentile (Median)	2.98	2.73	2.85				2.98	2.73	2.85
	75th Percentile	3.75	3.27	3.49				3.75	3.27	3.49
	Maximum Observed	5.34	5.33	5.34				5.34	5.33	5.34

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 30-39		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	49	151	200	0	0	0	49	151	200
	Mean	3.25	3.05	3.11				3.25	3.05	3.11
	Standard Deviation	2.53	1.92	2.09				2.53	1.92	2.09
	Minimum Observed	-2.83	-1.29	-2.83				-2.83	-1.29	-2.83
	25th Percentile	2.42	2.32	2.41				2.42	2.32	2.41
	50th Percentile (Median)	3.17	3.25	3.24				3.17	3.25	3.24
	75th Percentile	4.35	3.92	3.94				4.35	3.92	3.94
	Maximum Observed	5.54	5.46	5.54				5.54	5.46	5.54

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 40-49		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	55	105	160	0	0	0	55	105	160
	Mean	3.23	3.23	3.23				3.23	3.23	3.23
	Standard Deviation	2.42	1.67	1.95				2.42	1.67	1.95
	Minimum Observed	-0.95	0.13	-0.95				-0.95	0.13	-0.95
	25th Percentile	2.59	2.59	2.59				2.59	2.59	2.59
	50th Percentile (Median)	3.14	3.18	3.17				3.14	3.18	3.17
	75th Percentile	3.95	3.77	3.82				3.95	3.77	3.82
	Maximum Observed	5.89	5.84	5.89				5.89	5.84	5.89

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 50-59		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	55	76	131	0	0	0	55	76	131
	Mean	3.22	3.30	3.26				3.22	3.30	3.26
	Standard Deviation	2.70	2.34	2.49				2.70	2.34	2.49
	Minimum Observed	-0.21	-0.12	-0.21				-0.21	-0.12	-0.21
	25th Percentile	2.59	2.49	2.54				2.59	2.49	2.54
	50th Percentile (Median)	3.35	3.25	3.26				3.35	3.25	3.26
	75th Percentile	3.88	4.30	4.05				3.88	4.30	4.05
	Maximum Observed	6.15	5.90	6.15				6.15	5.90	6.15

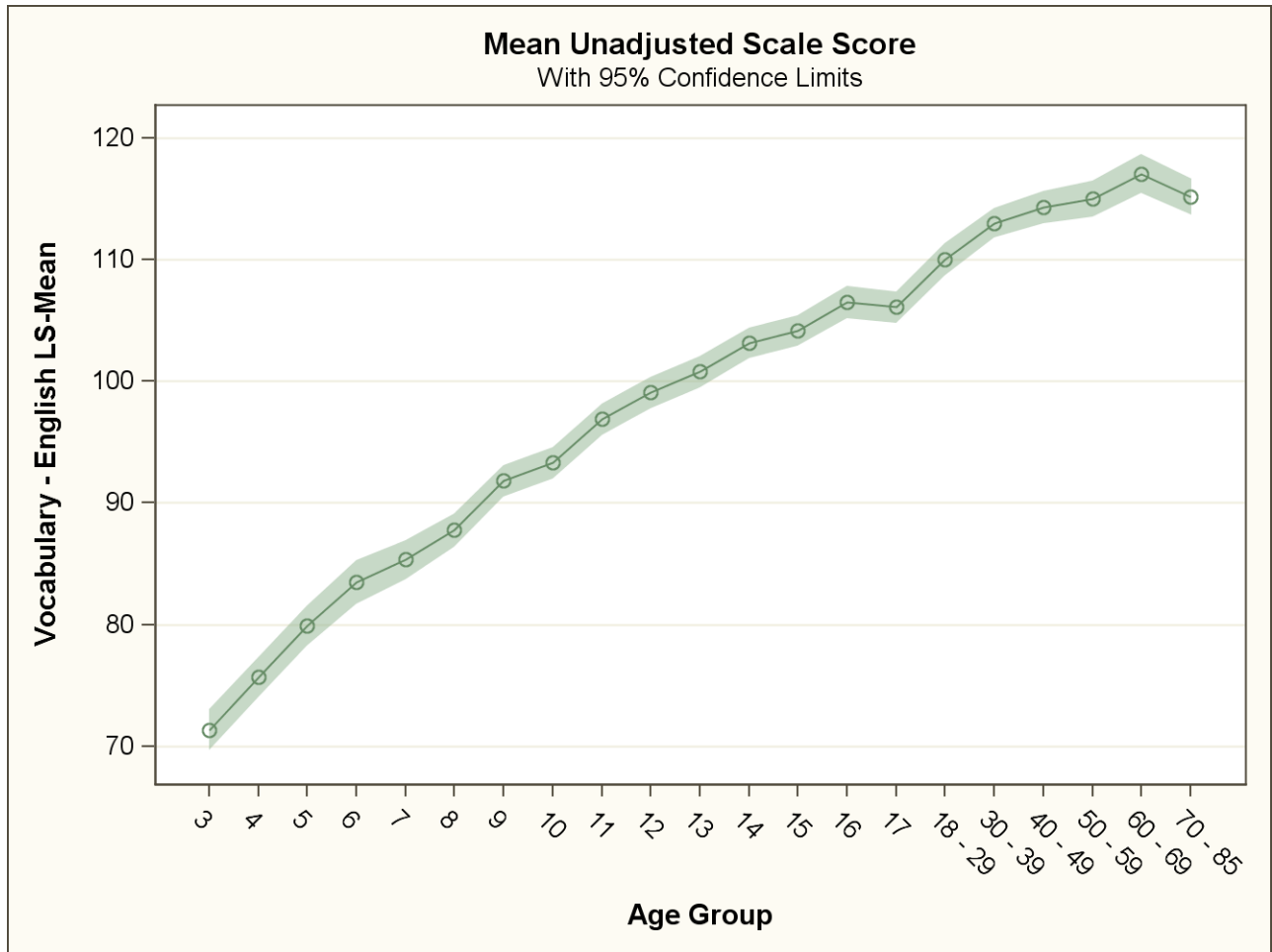
Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 60-69		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	43	64	107	0	0	0	43	64	107
	Mean	3.46	3.50	3.48				3.46	3.50	3.48
	Standard Deviation	3.43	2.14	2.71				3.43	2.14	2.71
	Minimum Observed	-2.12	0.48	-2.12				-2.12	0.48	-2.12
	25th Percentile	2.40	2.65	2.52				2.40	2.65	2.52
	50th Percentile (Median)	3.62	3.33	3.45				3.62	3.33	3.45
	75th Percentile	4.72	4.55	4.60				4.72	4.55	4.60
	Maximum Observed	5.89	6.76	6.76				5.89	6.76	6.76

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – Age 70-85		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	60	70	130	0	0	0	60	70	130
	Mean	3.09	3.35	3.21				3.09	3.35	3.21
	Standard Deviation	2.34	1.61	1.98				2.34	1.61	1.98
	Minimum Observed	-1.08	-1.33	-1.33				-1.08	-1.33	-1.33
	25th Percentile	2.42	2.54	2.53				2.42	2.54	2.53
	50th Percentile (Median)	3.15	3.40	3.24				3.15	3.40	3.24
	75th Percentile	4.25	4.18	4.20				4.25	4.18	4.20
	Maximum Observed	5.90	6.14	6.14				5.90	6.14	6.14

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – NCS Sample of Mothers		English	Spanish	All
	N	79	0	79
	Mean	3.18		3.18
	Standard Deviation	1.03		1.03
	Minimum Observed	0.80		0.80
	25th Percentile	2.50		2.50
	50th Percentile (Median)	3.23		3.23
	75th Percentile	3.77		3.77
	Maximum Observed	5.84		5.84

Table 2. NIH Toolbox Picture Vocabulary Test-English (theta) – NCS Sample of Pregnant Women		English	Spanish	All
	N	81	0	81
	Mean	2.92		2.92
	Standard Deviation	1.23		1.23
	Minimum Observed	-0.82		-0.82
	25th Percentile	2.15		2.15
	50th Percentile (Median)	3.11		3.11
	75th Percentile	3.75		3.75
	Maximum Observed	5.33		5.33

Figure 1
Least Squares Means



Section 11: Measure Norms-Spanish

The following Tables and Figure present NIH Toolbox normative data associated with this measure. Norms reported here should be interpreted cautiously, due to the limited subsample size.

Table 1. Measure Raw/Computed Score, Unadjusted Scale Score, and Fully Adjusted Scale Score Summary (N, Mean, Standard Deviation) by Age Group (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

Table 2. Measure Raw/Computed Score Statistics (N, Mean, Standard Deviation, Minimum/Maximum Observed, 25th/50th/75th Percentile) per Age Group (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

Figure 1. Measure Mean Unadjusted Scale Scores across All Age Groups (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85)

Table 1. NIH Toolbox Picture Vocabulary Test-Spanish by Age Group	Picture Vocabulary Test-Spanish (theta)			Vocabulary - Spanish Unadjusted Scale Score			Vocabulary - Spanish Fully Adjusted Scale Score		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Age Group									
3	50	-4.66	0.61	50	77.12	3.17	43	99.81	5.81
4	60	-3.23	0.65	60	84.17	3.15	52	99.87	5.67
5	53	-2.43	0.63	53	87.92	2.87	46	100.05	5.32
6	62	-1.54	0.61	62	91.82	2.77	51	99.97	5.21
7	88	-0.89	0.35	88	95.02	1.53	72	97.96	3.35
8	0			0			0		
9	0			0			0		
10	0			0			0		
11	0			0			0		
12	0			0			0		
13	0			0			0		
14	0			0			0		
15	0			0			0		
16	0			0			0		
17	0			0			0		
18 - 29	76	3.22	1.71	76	111.91	9.03	71	101.73	15.81
30 - 39	79	3.57	1.50	79	113.85	8.32	73	100.61	13.79
40 - 49	42	3.79	1.77	42	115.29	9.12	40	101.23	16.62
50 - 59	35	3.89	2.26	35	116.57	12.85	32	101.35	19.56
60 - 69	15	1.61	1.27	15	104.53	4.61	10	99.61	12.04
70 - 85	10	1.69	1.87	10	105.63	8.24	6	101.14	17.89
All	570	2.65	1.96	570	109.95	9.37	496	101.01	11.32

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 3		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	29	21	50	29	21	50
	Mean				-4.81	-4.33	-4.66	-4.81	-4.33	-4.66
	Standard Deviation				0.65	0.54	0.61	0.65	0.54	0.61
	Minimum Observed				-8.27	-6.40	-8.27	-8.27	-6.40	-8.27
	25th Percentile				-5.84	-5.84	-5.84	-5.84	-5.84	-5.84
	50th Percentile (Median)				-5.10	-4.06	-5.06	-5.10	-4.06	-5.06
	75th Percentile				-3.64	-3.13	-3.43	-3.64	-3.13	-3.43
	Maximum Observed				-1.63	-1.68	-1.63	-1.63	-1.68	-1.63

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 4		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	29	31	60	29	31	60
	Mean				-3.69	-2.54	-3.23	-3.69	-2.54	-3.23
	Standard Deviation				0.78	0.44	0.65	0.78	0.44	0.65
	Minimum Observed				-7.56	-5.42	-7.56	-7.56	-5.42	-7.56
	25th Percentile				-4.86	-3.52	-4.59	-4.86	-3.52	-4.59
	50th Percentile (Median)				-4.47	-2.70	-3.32	-4.47	-2.70	-3.32
	75th Percentile				-2.12	-1.27	-1.59	-2.12	-1.27	-1.59
	Maximum Observed				1.99	0.72	1.99	1.99	0.72	1.99

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 5		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	26	27	53	26	27	53
	Mean				-2.57	-2.24	-2.43	-2.57	-2.24	-2.43
	Standard Deviation				0.68	0.58	0.63	0.68	0.58	0.63
	Minimum Observed				-5.64	-6.89	-6.89	-5.64	-6.89	-6.89
	25th Percentile				-3.66	-3.29	-3.64	-3.66	-3.29	-3.64
	50th Percentile (Median)				-2.58	-2.14	-2.43	-2.58	-2.14	-2.43
	75th Percentile				-1.44	-0.88	-1.07	-1.44	-0.88	-1.07
	Maximum Observed				0.91	0.94	0.94	0.91	0.94	0.94

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 6		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	28	34	62	28	34	62
	Mean				-1.50	-1.60	-1.54	-1.50	-1.60	-1.54
	Standard Deviation				0.66	0.57	0.61	0.66	0.57	0.61
	Minimum Observed				-6.11	-7.35	-7.35	-6.11	-7.35	-7.35
	25th Percentile				-2.31	-2.39	-2.34	-2.31	-2.39	-2.34
	50th Percentile (Median)				-1.46	-1.42	-1.46	-1.46	-1.42	-1.46
	75th Percentile				-0.88	-0.71	-0.78	-0.88	-0.71	-0.78
	Maximum Observed				2.96	1.70	2.96	2.96	1.70	2.96

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 7		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	43	45	88	43	45	88
	Mean				-0.91	-0.85	-0.89	-0.91	-0.85	-0.89
	Standard Deviation				0.43	0.27	0.35	0.43	0.27	0.35
	Minimum Observed				-3.67	-3.23	-3.67	-3.67	-3.23	-3.67
	25th Percentile				-1.58	-1.40	-1.54	-1.58	-1.40	-1.54
	50th Percentile (Median)				-0.97	-0.85	-0.90	-0.97	-0.85	-0.90
	75th Percentile				-0.38	-0.29	-0.29	-0.38	-0.29	-0.29
	Maximum Observed				1.60	1.70	1.70	1.60	1.70	1.70

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 18-29		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	14	62	76	14	62	76
	Mean				3.26	3.20	3.22	3.26	3.20	3.22
	Standard Deviation				1.79	1.70	1.71	1.79	1.70	1.71
	Minimum Observed				0.94	-1.25	-1.25	0.94	-1.25	-1.25
	25th Percentile				2.22	2.08	2.08	2.22	2.08	2.08
	50th Percentile (Median)				3.23	3.12	3.13	3.23	3.12	3.13
	75th Percentile				4.26	4.28	4.26	4.26	4.28	4.26
	Maximum Observed				5.28	6.78	6.78	5.28	6.78	6.78

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 30-39		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	20	59	79	20	59	79
	Mean				3.68	3.51	3.57	3.68	3.51	3.57
	Standard Deviation				1.76	1.42	1.50	1.76	1.42	1.50
	Minimum Observed				-0.69	-0.10	-0.69	-0.69	-0.10	-0.69
	25th Percentile				2.77	2.24	2.58	2.77	2.24	2.58
	50th Percentile (Median)				3.85	3.39	3.64	3.85	3.39	3.64
	75th Percentile				4.89	4.74	4.79	4.89	4.74	4.79
	Maximum Observed				6.90	8.69	8.69	6.90	8.69	8.69

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 40-49		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	16	26	42	16	26	42
	Mean				3.42	4.11	3.79	3.42	4.11	3.79
	Standard Deviation				2.21	1.42	1.77	2.21	1.42	1.77
	Minimum Observed				-0.13	0.37	-0.13	-0.13	0.37	-0.13
	25th Percentile				2.55	3.29	3.13	2.55	3.29	3.13
	50th Percentile (Median)				3.94	4.41	4.25	3.94	4.41	4.25
	75th Percentile				4.83	5.18	4.98	4.83	5.18	4.98
	Maximum Observed				5.62	6.33	6.33	5.62	6.33	6.33

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 50-59		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	16	19	35	16	19	35
	Mean				3.58	4.32	3.89	3.58	4.32	3.89
	Standard Deviation				2.92	1.47	2.26	2.92	1.47	2.26
	Minimum Observed				-0.49	0.93	-0.49	-0.49	0.93	-0.49
	25th Percentile				2.15	3.46	2.17	2.15	3.46	2.17
	50th Percentile (Median)				3.84	4.41	4.04	3.84	4.41	4.04
	75th Percentile				5.14	5.31	5.20	5.14	5.31	5.20
	Maximum Observed				7.01	6.35	7.01	7.01	6.35	7.01

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 60-69		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	7	8	15	7	8	15
	Mean				1.11	2.41	1.61	1.11	2.41	1.61
	Standard Deviation				1.26	1.00	1.27	1.26	1.00	1.27
	Minimum Observed				-0.44	0.74	-0.44	-0.44	0.74	-0.44
	25th Percentile				-0.22	0.92	0.86	-0.22	0.92	0.86
	50th Percentile (Median)				0.89	2.74	1.85	0.89	2.74	1.85
	75th Percentile				2.06	3.30	2.64	2.06	3.30	2.64
	Maximum Observed				2.64	3.87	3.87	2.64	3.87	3.87

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – Age 70-85		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	0	0	0	4	6	10	4	6	10
	Mean				2.47	1.08	1.69	2.47	1.08	1.69
	Standard Deviation				1.92	1.91	1.87	1.92	1.91	1.87
	Minimum Observed				-1.64	-2.56	-2.56	-1.64	-2.56	-2.56
	25th Percentile				2.38	-0.79	-0.79	2.38	-0.79	-0.79
	50th Percentile (Median)				4.03	0.92	2.38	4.03	0.92	2.38
	75th Percentile				4.03	2.89	4.03	4.03	2.89	4.03
	Maximum Observed				4.48	5.71	5.71	4.48	5.71	5.71

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – NCS Sample of Mothers		English	Spanish	All
	N	0	33	33
	Mean		3.64	3.64
	Standard Deviation		1.48	1.48
	Minimum Observed		0.71	0.71
	25th Percentile		2.51	2.51
	50th Percentile (Median)		3.60	3.60
	75th Percentile		4.94	4.94
	Maximum Observed		6.21	6.21

Table 2. NIH Toolbox Picture Vocabulary Test-Spanish (theta) – NCS Sample of Pregnant Women		English	Spanish	All
	N	0	38	38
	Mean		3.17	3.17
	Standard Deviation		1.42	1.42
	Minimum Observed		0.86	0.86
	25th Percentile		2.08	2.08
	50th Percentile (Median)		2.97	2.97
	75th Percentile		4.03	4.03
	Maximum Observed		6.78	6.78

Figure 1
Least Squares Means

