

NIH Toolbox



Technical Manual

Jerry Slotkin, PhD, Michael Kallen, PhD, James Griffith, PhD, Susan Magasi, PhD, John Salsman, PhD, Cindy Nowinski, MD, PhD, and Richard Gershon, PhD

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NIH Toolbox Technical Manual

Domain:

COGNITION

Subdomain:

WORKING MEMORY

Measure:

NIH Toolbox List Sorting Working Memory Test

Expert Contributors-COGNITION

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

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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: 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 also 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. With its notion of an active computational workspace, Working Memory is a conceptual update to the construct "short-term memory" that refers to a passive storage buffer. In NIH Toolbox, Working Memory is measured by:

NIH Toolbox List Sorting Working Memory Test

Section 7: Measure Description

COGNITION Core Measure

The NIH Toolbox List Sorting Working Memory Test (List Sorting) requires immediate recall and sequencing of different visually and orally presented stimuli. Pictures of different foods and animals are displayed with accompanying audio recording and written text (e.g., "elephant"), and the participant is asked to say the items back in size order from smallest to largest, first within a single dimension (either animals or foods, called 1-List) and then on two dimensions

(foods, *then* animals, called 2-List). The test takes approximately seven minutes to administer and is recommended for ages 7-85, though it is available for use as young as age 3.

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:

Practice testing changes: For ages 3-6, the test is discontinued after two trial failures on a practice item, rather than after three failures.

Test administration changes: The test is recommended for ages 7+, but it can successfully be administered to younger ages (i.e., ages 3-6).

Section 9: The Measure's Scoring Model

Measurement theory applied for scoring:

Classical Test Theory (CTT)

CTT scoring approach employed:

Sum (the total number of items correctly recalled and sequenced on 1-List and 2-List)

Measure length:

Fixed

Response data:

Dichotomous

Scores computed/available*:

Sum (range 0 to 26)

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)

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

Section 10: Measure Norms

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 List Sorting Working Memory Test by Age Group	List Sorting Working Memory Test (number correct)			List Sorting Unadjusted Scale Score			List Sorting Fully Adjusted Scale Score		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Age Group									
3	70	4.85	1.94	70	72.53	5.01	64	99.15	9.45
4	168	6.18	1.40	168	76.03	3.60	157	99.44	7.18
5	194	8.29	1.92	194	81.05	4.66	178	99.29	9.10
6	207	10.73	2.19	207	86.82	5.47	185	99.58	10.06
7	245	12.83	1.69	245	91.99	4.58	222	99.39	7.97
8	209	14.52	1.84	209	96.89	5.75	200	99.47	9.01
9	221	15.88	1.69	221	101.35	5.98	207	99.35	8.19
10	232	16.38	1.87	232	103.42	6.69	214	99.35	8.85
11	221	16.66	1.58	221	104.09	5.75	209	99.43	7.81
12	220	17.19	1.55	220	105.97	5.83	210	99.44	7.58
13	222	17.53	1.67	222	107.45	6.24	214	99.58	7.95
14	235	17.91	1.64	235	108.89	6.33	227	99.51	7.77
15	223	18.36	1.76	223	110.71	7.05	216	99.48	8.29
16	216	18.37	1.61	216	110.57	6.50	206	99.36	7.73
17	225	18.40	1.70	225	110.91	6.55	217	99.43	8.18
18 - 29	266	18.56	5.40	266	111.56	21.50	256	99.32	24.37
30 - 39	307	17.69	4.50	307	108.03	17.52	291	99.34	21.00
40 - 49	254	17.65	5.52	254	108.14	20.84	238	99.46	24.17
50 - 59	188	16.28	5.72	188	102.76	20.10	172	99.68	27.12
60 - 69	163	15.65	5.83	163	100.73	19.74	150	99.47	26.96
70 - 85	238	13.74	4.49	238	94.80	12.98	211	99.74	20.86
All	4524	16.56	4.03	4524	104.46	13.81	4244	99.46	14.92

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 3		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	19	27	46	9	15	24	28	42	70
	Mean	5.55	4.62	5.10	3.59	3.15	3.39	5.25	4.41	4.85
	Standard Deviation	2.65	1.92	2.25	1.09	0.93	0.98	2.30	1.65	1.94
	Minimum Observed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25th Percentile	4.00	3.00	4.00	2.00	0.00	2.00	4.00	2.00	3.00
	50th Percentile (Median)	5.00	5.00	5.00	4.00	3.00	4.00	4.00	5.00	5.00
	75th Percentile	8.00	6.00	6.00	4.00	4.00	4.00	7.00	6.00	6.00
	Maximum Observed	13.00	12.00	13.00	7.00	10.00	10.00	13.00	12.00	13.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 4		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	49	54	103	27	38	65	76	92	168
	Mean	6.45	6.05	6.28	5.48	5.70	5.59	6.33	5.99	6.18
	Standard Deviation	1.76	1.50	1.62	1.09	0.84	0.94	1.56	1.26	1.40
	Minimum Observed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25th Percentile	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	50th Percentile (Median)	7.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
	75th Percentile	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
	Maximum Observed	11.00	12.00	12.00	10.00	10.00	10.00	11.00	12.00	12.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 5		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	60	59	119	36	39	75	96	98	194
	Mean	8.60	8.50	8.56	6.54	7.24	6.83	8.28	8.29	8.29
	Standard Deviation	2.21	2.14	2.16	1.47	1.23	1.35	2.01	1.84	1.92
	Minimum Observed	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
	25th Percentile	7.00	6.00	6.00	3.00	6.00	4.00	6.00	6.00	6.00
	50th Percentile (Median)	8.00	8.00	8.00	6.00	6.00	6.00	8.00	8.00	8.00
	75th Percentile	10.00	11.00	11.00	11.00	10.00	10.00	10.00	11.00	10.00
	Maximum Observed	18.00	19.00	19.00	14.00	16.00	16.00	18.00	19.00	19.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 6		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	61	62	123	37	47	84	98	109	207
	Mean	11.17	11.32	11.23	7.60	9.24	8.34	10.60	10.93	10.73
	Standard Deviation	2.92	2.06	2.51	1.41	1.13	1.29	2.59	1.76	2.19
	Minimum Observed	0.00	1.00	0.00	0.00	4.00	0.00	0.00	1.00	0.00
	25th Percentile	8.00	9.00	9.00	6.00	7.00	6.00	8.00	9.00	8.00
	50th Percentile (Median)	12.00	12.00	12.00	8.00	9.00	8.00	10.00	11.00	11.00
	75th Percentile	14.00	14.00	14.00	10.00	12.00	10.00	14.00	14.00	14.00
	Maximum Observed	20.00	17.00	20.00	17.00	23.00	23.00	20.00	23.00	23.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 7		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	80	78	158	43	44	87	123	122	245
	Mean	13.17	13.29	13.22	10.46	10.43	10.45	12.80	12.87	12.83
	Standard Deviation	1.94	1.77	1.86	1.28	0.75	1.04	1.82	1.55	1.69
	Minimum Observed	6.00	5.00	5.00	3.00	5.00	3.00	3.00	5.00	3.00
	25th Percentile	12.00	10.00	11.00	8.00	9.00	8.00	11.00	10.00	10.00
	50th Percentile (Median)	14.00	13.00	14.00	11.00	10.00	10.00	13.00	12.00	13.00
	75th Percentile	15.00	16.00	15.00	13.00	12.00	12.00	15.00	15.00	15.00
	Maximum Observed	19.00	21.00	21.00	18.00	16.00	18.00	19.00	21.00	21.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 8		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	106	103	209	0	0	0	106	103	209
	Mean	14.52	14.51	14.52				14.52	14.51	14.52
	Standard Deviation	1.89	1.79	1.84				1.89	1.79	1.84
	Minimum Observed	5.00	3.00	3.00				5.00	3.00	3.00
	25th Percentile	12.00	12.00	12.00				12.00	12.00	12.00
	50th Percentile (Median)	15.00	14.00	15.00				15.00	14.00	15.00
	75th Percentile	16.00	16.00	16.00				16.00	16.00	16.00
	Maximum Observed	23.00	24.00	24.00				23.00	24.00	24.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 9		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	110	111	221	0	0	0	110	111	221
	Mean	15.88	15.87	15.88				15.88	15.87	15.88
	Standard Deviation	1.85	1.53	1.69				1.85	1.53	1.69
	Minimum Observed	7.00	10.00	7.00				7.00	10.00	7.00
	25th Percentile	14.00	14.00	14.00				14.00	14.00	14.00
	50th Percentile (Median)	16.00	16.00	16.00				16.00	16.00	16.00
	75th Percentile	18.00	18.00	18.00				18.00	18.00	18.00
	Maximum Observed	22.00	26.00	26.00				22.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 10		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	118	114	232	0	0	0	118	114	232
	Mean	16.25	16.59	16.38				16.25	16.59	16.38
	Standard Deviation	2.21	1.44	1.87				2.21	1.44	1.87
	Minimum Observed	3.00	6.00	3.00				3.00	6.00	3.00
	25th Percentile	14.00	14.00	14.00				14.00	14.00	14.00
	50th Percentile (Median)	16.00	16.00	16.00				16.00	16.00	16.00
	75th Percentile	19.00	19.00	19.00				19.00	19.00	19.00
	Maximum Observed	26.00	25.00	26.00				26.00	25.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 11		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	112	109	221	0	0	0	112	109	221
	Mean	16.76	16.51	16.66				16.76	16.51	16.66
	Standard Deviation	1.66	1.50	1.58				1.66	1.50	1.58
	Minimum Observed	10.00	8.00	8.00				10.00	8.00	8.00
	25th Percentile	15.00	15.00	15.00				15.00	15.00	15.00
	50th Percentile (Median)	17.00	17.00	17.00				17.00	17.00	17.00
	75th Percentile	19.00	19.00	19.00				19.00	19.00	19.00
	Maximum Observed	22.00	22.00	22.00				22.00	22.00	22.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 12		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	103	117	220	0	0	0	103	117	220
	Mean	17.14	17.24	17.19				17.14	17.24	17.19
	Standard Deviation	1.67	1.45	1.55				1.67	1.45	1.55
	Minimum Observed	8.00	8.00	8.00				8.00	8.00	8.00
	25th Percentile	16.00	16.00	16.00				16.00	16.00	16.00
	50th Percentile (Median)	18.00	18.00	18.00				18.00	18.00	18.00
	75th Percentile	19.00	19.00	19.00				19.00	19.00	19.00
	Maximum Observed	24.00	23.00	24.00				24.00	23.00	24.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 13		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	118	104	222	0	0	0	118	104	222
	Mean	17.58	17.43	17.53				17.58	17.43	17.53
	Standard Deviation	1.87	1.42	1.67				1.87	1.42	1.67
	Minimum Observed	8.00	9.00	8.00				8.00	9.00	8.00
	25th Percentile	16.00	16.00	16.00				16.00	16.00	16.00
	50th Percentile (Median)	18.00	18.00	18.00				18.00	18.00	18.00
	75th Percentile	20.00	19.00	19.00				20.00	19.00	19.00
	Maximum Observed	26.00	25.00	26.00				26.00	25.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 14		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	114	121	235	0	0	0	114	121	235
	Mean	17.94	17.88	17.91				17.94	17.88	17.91
	Standard Deviation	1.82	1.47	1.64				1.82	1.47	1.64
	Minimum Observed	8.00	4.00	4.00				8.00	4.00	4.00
	25th Percentile	16.00	16.00	16.00				16.00	16.00	16.00
	50th Percentile (Median)	18.00	18.00	18.00				18.00	18.00	18.00
	75th Percentile	20.00	20.00	20.00				20.00	20.00	20.00
	Maximum Observed	26.00	25.00	26.00				26.00	25.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 15		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	110	113	223	0	0	0	110	113	223
	Mean	18.57	18.08	18.36				18.57	18.08	18.36
	Standard Deviation	1.93	1.57	1.76				1.93	1.57	1.76
	Minimum Observed	10.00	5.00	5.00				10.00	5.00	5.00
	25th Percentile	17.00	16.00	16.00				17.00	16.00	16.00
	50th Percentile (Median)	18.00	18.00	18.00				18.00	18.00	18.00
	75th Percentile	21.00	20.00	20.00				21.00	20.00	20.00
	Maximum Observed	26.00	26.00	26.00				26.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 16		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	108	108	216	0	0	0	108	108	216
	Mean	18.48	18.20	18.37				18.48	18.20	18.37
	Standard Deviation	1.66	1.56	1.61				1.66	1.56	1.61
	Minimum Observed	13.00	10.00	10.00				13.00	10.00	10.00
	25th Percentile	17.00	17.00	17.00				17.00	17.00	17.00
	50th Percentile (Median)	18.00	18.00	18.00				18.00	18.00	18.00
	75th Percentile	20.00	20.00	20.00				20.00	20.00	20.00
	Maximum Observed	26.00	25.00	26.00				26.00	25.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 17		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	111	114	225	0	0	0	111	114	225
	Mean	18.43	18.35	18.40				18.43	18.35	18.40
	Standard Deviation	1.87	1.52	1.70				1.87	1.52	1.70
	Minimum Observed	7.00	7.00	7.00				7.00	7.00	7.00
	25th Percentile	17.00	17.00	17.00				17.00	17.00	17.00
	50th Percentile (Median)	19.00	18.00	19.00				19.00	18.00	19.00
	75th Percentile	20.00	20.00	20.00				20.00	20.00	20.00
	Maximum Observed	25.00	26.00	26.00				25.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 18-29		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	60	113	173	21	72	93	81	185	266
	Mean	19.57	18.50	19.00	16.23	15.51	15.74	19.25	18.00	18.56
	Standard Deviation	5.98	5.16	5.55	4.65	3.58	3.84	6.03	4.94	5.40
	Minimum Observed	12.00	12.00	12.00	10.00	5.00	5.00	10.00	5.00	5.00
	25th Percentile	18.00	17.00	17.00	14.00	13.00	14.00	18.00	16.00	17.00
	50th Percentile (Median)	20.00	19.00	19.00	17.00	16.00	16.00	19.00	18.00	19.00
	75th Percentile	21.00	20.00	21.00	18.00	18.00	18.00	21.00	20.00	20.00
	Maximum Observed	26.00	26.00	26.00	25.00	25.00	25.00	26.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 30-39		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	54	155	209	21	77	98	75	232	307
	Mean	17.92	17.84	17.87	16.78	16.22	16.39	17.79	17.64	17.69
	Standard Deviation	6.53	4.39	5.01	2.96	2.91	2.91	5.77	4.02	4.50
	Minimum Observed	5.00	10.00	5.00	10.00	6.00	6.00	5.00	6.00	5.00
	25th Percentile	16.00	16.00	16.00	15.00	14.00	14.00	16.00	16.00	16.00
	50th Percentile (Median)	18.00	18.00	18.00	16.00	16.00	16.00	18.00	18.00	18.00
	75th Percentile	20.00	20.00	20.00	19.00	18.00	18.00	20.00	19.00	20.00
	Maximum Observed	26.00	26.00	26.00	22.00	24.00	24.00	26.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 40-49		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	62	119	181	30	43	73	92	162	254
	Mean	17.99	18.08	18.04	13.77	15.00	14.37	17.46	17.80	17.65
	Standard Deviation	6.24	5.46	5.72	4.16	2.93	3.52	6.19	5.11	5.52
	Minimum Observed	10.00	8.00	8.00	6.00	8.00	6.00	6.00	8.00	6.00
	25th Percentile	16.00	16.00	16.00	12.00	14.00	12.00	15.00	16.00	16.00
	50th Percentile (Median)	18.00	19.00	18.00	14.00	14.00	14.00	18.00	18.00	18.00
	75th Percentile	20.00	20.00	20.00	16.00	16.00	16.00	20.00	20.00	20.00
	Maximum Observed	24.00	25.00	25.00	22.00	25.00	25.00	24.00	25.00	25.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 50-59		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	56	84	140	22	26	48	78	110	188
	Mean	16.39	16.58	16.48	14.92	13.48	14.30	16.24	16.32	16.28
	Standard Deviation	6.53	6.08	6.25	2.81	2.96	2.98	5.79	5.69	5.72
	Minimum Observed	10.00	6.00	6.00	8.00	7.00	7.00	8.00	6.00	6.00
	25th Percentile	15.00	14.00	14.00	14.00	12.00	13.00	15.00	14.00	14.00
	50th Percentile (Median)	17.00	16.00	17.00	15.00	14.00	14.00	16.00	16.00	16.00
	75th Percentile	18.00	20.00	19.00	16.00	15.00	16.00	18.00	19.00	18.00
	Maximum Observed	22.00	24.00	24.00	18.00	19.00	19.00	22.00	24.00	24.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 60-69		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	48	71	119	19	25	44	67	96	163
	Mean	15.73	16.24	15.98	12.60	11.87	12.27	15.43	15.89	15.65
	Standard Deviation	6.55	5.86	6.14	3.87	3.26	3.51	6.14	5.61	5.83
	Minimum Observed	8.00	4.00	4.00	6.00	5.00	5.00	6.00	4.00	4.00
	25th Percentile	14.00	14.00	14.00	10.00	8.00	10.00	14.00	14.00	14.00
	50th Percentile (Median)	16.00	16.00	16.00	12.00	12.00	12.00	15.00	16.00	16.00
	75th Percentile	18.00	18.00	18.00	14.00	14.00	14.00	18.00	18.00	18.00
	Maximum Observed	23.00	26.00	26.00	21.00	18.00	21.00	23.00	26.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – Age 70-85		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	94	103	197	24	17	41	118	120	238
	Mean	13.57	14.29	13.88	10.78	11.90	11.15	13.41	14.20	13.74
	Standard Deviation	5.43	4.10	4.79	2.09	1.73	1.96	5.00	3.89	4.49
	Minimum Observed	3.00	4.00	3.00	6.00	7.00	6.00	3.00	4.00	3.00
	25th Percentile	12.00	13.00	12.00	8.00	10.00	9.00	11.00	12.00	12.00
	50th Percentile (Median)	14.00	14.00	14.00	10.00	13.00	11.00	14.00	14.00	14.00
	75th Percentile	16.00	16.00	16.00	13.00	14.00	14.00	16.00	16.00	16.00
	Maximum Observed	22.00	21.00	22.00	16.00	16.00	16.00	22.00	21.00	22.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – NCS Sample of Mothers		English	Spanish	All
	N	80	35	115
	Mean	18.58	16.31	17.89
	Standard Deviation	3.33	3.30	3.47
	Minimum Observed	9.00	8.00	8.00
	25th Percentile	16.50	14.00	16.00
	50th Percentile (Median)	19.00	16.00	18.00
	75th Percentile	21.00	19.00	20.00
	Maximum Observed	26.00	23.00	26.00

Table 2. NIH Toolbox List Sorting Working Memory Test (number correct) – NCS Sample of Pregnant Women		English	Spanish	All
	N	81	44	125
	Mean	17.57	15.59	16.87
	Standard Deviation	2.87	3.21	3.13
	Minimum Observed	8.00	5.00	5.00
	25th Percentile	16.00	14.00	15.00
	50th Percentile (Median)	18.00	16.00	17.00
	75th Percentile	19.00	18.00	19.00
	Maximum Observed	26.00	25.00	26.00

Figure 1
Least Squares Means

