

# NIH Toolbox



## Technical Manual

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# **NIH Toolbox Technical Manual**

**Domain:**

**SENSATION**

**Subdomain:**

**TASTE**

**Measure:**

**NIH Toolbox Taste Intensity Test**

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This Technical Manual contains the following informational sections:

**Section 1: Introduction to NIH Toolbox**

**Section 2: Validation**

**Section 3: Norming**

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

**Section 5: Domain Definition**

**Section 6: Subdomain Definition**

**Section 7: Measure Description**

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

**Section 9: The Measure's Scoring Model**

**Section 10: Measure Norms-Quinine**

**Section 11: Measure Norms-Salt**

## **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 Sensation 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 Sensation domain measure validation, see: Coldwell et al. Gustation assessment using the NIH Toolbox. *Neurology*. 2013;80( 11 Supplement 3):S20-S24.; Cook et al. Pain assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S49-S53.; Dalton et al. Olfactory assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S32-S36.; Dunn et al. Somatosensation assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S41-S44.; Paz et al., Development of a Vision-Targeted Health Related Quality Of Life Item Measure. *Qual. Life Res*. 2013;22(9):2477-2487.; Rine et al., Vestibular function assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S25-S31; Varma et al., Vision assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S37-S40; Zecker et al., Audition assessment using the NIH Toolbox. *Neurology*. 2013;80(11 Supplement 3):S45-S48. These manuscripts describe 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: 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, in academic and occupational endeavors, and for 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. The Sensation domain includes measures of:

## **AUDITION**

Measured by:

NIH Toolbox Words\in\Noise Test

NIH Toolbox Hearing Threshold Test (Supplemental Measure)

NIH Toolbox Hearing Handicap Inventory (Supplemental Measure)

## **OLFACTION**

Measured by:

NIH Toolbox Odor Identification Test

## **PAIN**

Measured by:

NIH Toolbox Pain Intensity Survey

NIH Toolbox Pain Interference Survey

## **TASTE**

Measured by:

NIH Toolbox Taste Intensity Test

## **VESTIBULAR**

Measured by:

NIH Toolbox Dynamic Visual Acuity Test

NIH Toolbox Standing Balance Test (contained within the NIH Toolbox Motor battery)

## **VISION**

Measured by:

NIH Toolbox Visual Acuity Test

NIH Toolbox Vision\Related Quality of Life Survey (Supplemental Measure)

## **SENSATION Batteries**

The NIH Toolbox Sensation Battery for ages 3\5 includes Visual Acuity, Dynamic Visual Acuity, and Odor Identification tests. For ages 6\11, the Words\in\Noise Test is added to the battery. For ages 12\17, the Taste Intensity Test is included with the other four; and for ages 18\85, the two Pain surveys are added. There are individual scores provided for each measure, as described below, but no composite scores.

## **Section 6: Subdomain Definition**

### **Subdomain: 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 battery 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. In NIH Toolbox, Taste is measured by:

NIH Toolbox Taste Intensity Test

## Section 7: Measure Description

### TASTE Core Measure

The NIH Toolbox Taste Intensity Test measures the perceived intensity of quinine (a bitter tastant) and salt administered in liquid solutions. The tastants are each applied to the tip of the tongue as well as swished around in the whole mouth and are rated on a generalized labeled magnitude scale (gLMS). The gLMS is a measure of perceived intensity, with seven anchor labels provided (*Strongest imaginable, Very strong, Strong, Moderate, Weak, Barely detectable, No sensation*). Participants can rate their intensity by clicking with a computer mouse on any point on the scale from *Strongest imaginable* to *No sensation*. The computer records the exact location of each response. The test is recommended for administration to participants ages 12\85 and takes approximately six minutes to administer.

## Section 8: Post Validation/Post Norming Changes to The Measure

Test administration changes: In addition to bitter taste, the optional salt taste was used in norming.

Note: Because the bitter taste of quinine hydrochloride, which is used in the NIH Toolbox Taste Intensity test, has a strong negative hedonic component, if one were to administer a sucrose preference test, it should not be administered in the same test session. If both tests were to be used with a participant, they should be administered on separate days.

## Section 9: The Measure's Scoring Model

Measurement theory applied for scoring:

Classical Test Theory (CTT)

CTT scoring approach employed:

Level of Perceived tastant intensity

Metric: generalized labeled magnitude scale (gLMS) (a measure of perceived intensity)

Measure length:

Fixed

Response data:

Continuous (perceived tastant intensity level; higher score = greater perceived intensity;

seven-point response set: Strongest imaginable, Very strong, Strong, Moderate, Weak,

Barely detectable, No sensation)

Scores computed/available\*:

Quinine Whole Mouth Score (range from 0\100 on a semi-logarithmic scale; corresponds to the point on the gLMS response scale which the examinee selected)

Salt Whole Mouth Score (range from 0\100 on a semi-logarithmic scale)

Quinine Tip of Tongue Score (range from 0\100 on a semi-logarithmic scale)

Salt Tip of Tongue Score (range from 0\100 on a semi-logarithmic scale)

Age\Adjusted Scale Score (from the Quinine Whole Mouth Score; mean=100, standard deviation=15)

Fully Adjusted Scale Score (Quinine Whole Mouth; mean=100, standard deviation=15)

Unadjusted Scale Score (Quinine Whole Mouth; mean=100, standard deviation=15)

National Percentile Rank (Quinine Whole Mouth; corresponds to the Age\Adjusted Scale Score)

Age\Adjusted Scale Score (Salt Whole Mouth; mean=100, standard deviation=15)

Fully Adjusted Scale Score (Salt Whole Mouth; mean=100, standard deviation=15)

Unadjusted Scale Score (Salt Whole Mouth; mean=100, standard deviation=15)

National Percentile Rank (Salt Whole Mouth; 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-Quinine

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

**Table 1. Quinine Whole Mouth Score, Unadjusted Scale Score, and Fully Adjusted Scale Score Summary (N, Mean, Standard Deviation) by Age Group (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)**

**Table 2. Quinine Whole Mouth Score Statistics (N, Mean, Standard Deviation, Minimum/Maximum Observed, 25<sup>th</sup>/50<sup>th</sup>/75<sup>th</sup> Percentile) per Age Group (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)**

**Figure 1. Quinine Mean Unadjusted Scale Scores across All Age Groups (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85)**

Table 1. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth by Age Group	Regional Taste Intensity Test - Quinine Whole Mouth (0-100)			Quinine - Whole Mouth Unadjusted Scale Score			Quinine - Whole Mouth Fully Adjusted Scale Score		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
	Age Group								
3	0			0			0		
4	0			0			0		
5	0			0			0		
6	0			0			0		
7	0			0			0		
8	0			0			0		
9	0			0			0		
10	0			0			0		
11	0			0			0		
12	194	59.18	13.77	194	103.16	9.42	185	99.55	9.29
13	209	57.51	12.87	209	102.17	8.62	201	99.63	8.87
14	217	54.54	11.29	217	100.57	7.61	210	100.27	7.48
15	206	54.68	13.73	206	100.08	9.24	201	100.08	9.50
16	199	52.98	12.43	199	99.02	8.27	190	100.17	8.24
17	209	56.76	12.55	209	101.52	8.04	202	99.82	8.35
18 - 29	248	53.74	37.68	248	99.70	24.24	241	100.03	23.82
30 - 39	288	55.70	34.62	288	100.68	22.72	278	99.70	23.01
40 - 49	239	49.62	36.40	239	96.92	24.59	227	100.52	24.36
50 - 59	185	49.04	39.85	185	96.62	26.87	171	100.54	27.98
60 - 69	143	45.11	37.15	143	93.88	26.52	138	100.46	26.63
70 - 85	220	46.55	27.31	220	94.87	18.59	199	100.29	19.98
All	2557	51.14	27.40	2557	97.90	18.34	2443	100.21	18.27

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 12		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	92	102	194	0	0	0	92	102	194
	Mean	58.55	60.01	59.18				58.55	60.01	59.18
	Standard Deviation	15.19	12.41	13.77				15.19	12.41	13.77
	Minimum Observed	0.00	0.00	0.00				0.00	0.00	0.00
	25th Percentile	41.00	40.00	41.00				41.00	40.00	41.00
	50th Percentile (Median)	55.00	55.00	55.00				55.00	55.00	55.00
	75th Percentile	75.00	80.00	76.00				75.00	80.00	76.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 13		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	115	94	209	0	0	0	115	94	209
	Mean	57.51	57.50	57.51				57.51	57.50	57.51
	Standard Deviation	13.76	11.77	12.87				13.76	11.77	12.87
	Minimum Observed	2.00	0.00	0.00				2.00	0.00	0.00
	25th Percentile	40.00	39.00	39.00				40.00	39.00	39.00
	50th Percentile (Median)	54.00	55.00	54.00				54.00	55.00	54.00
	75th Percentile	74.00	77.00	74.00				74.00	77.00	74.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 14		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	107	110	217	0	0	0	107	110	217
	Mean	51.82	58.66	54.54				51.82	58.66	54.54
	Standard Deviation	11.21	11.12	11.29				11.21	11.12	11.29
	Minimum Observed	6.00	4.00	4.00				6.00	4.00	4.00
	25th Percentile	37.00	43.00	39.00				37.00	43.00	39.00
	50th Percentile (Median)	50.00	56.00	53.00				50.00	56.00	53.00
	75th Percentile	61.00	75.00	67.00				61.00	75.00	67.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 15		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	101	105	206	0	0	0	101	105	206
	Mean	53.00	56.90	54.68				53.00	56.90	54.68
	Standard Deviation	14.49	12.95	13.73				14.49	12.95	13.73
	Minimum Observed	8.00	0.00	0.00				8.00	0.00	0.00
	25th Percentile	36.00	38.00	36.00				36.00	38.00	36.00
	50th Percentile (Median)	50.00	53.00	52.00				50.00	53.00	52.00
	75th Percentile	60.00	79.00	70.00				60.00	79.00	70.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 16		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	100	99	199	0	0	0	100	99	199
	Mean	52.17	54.15	52.98				52.17	54.15	52.98
	Standard Deviation	12.57	12.31	12.43				12.57	12.31	12.43
	Minimum Observed	6.00	3.00	3.00				6.00	3.00	3.00
	25th Percentile	37.00	35.00	37.00				37.00	35.00	37.00
	50th Percentile (Median)	50.00	50.00	50.00				50.00	50.00	50.00
	75th Percentile	64.00	71.00	67.00				64.00	71.00	67.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 17		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	106	103	209	0	0	0	106	103	209
	Mean	52.93	63.42	56.76				52.93	63.42	56.76
	Standard Deviation	13.36	10.97	12.55				13.36	10.97	12.55
	Minimum Observed	12.00	6.00	6.00				12.00	6.00	6.00
	25th Percentile	38.00	50.00	40.00				38.00	50.00	40.00
	50th Percentile (Median)	52.00	59.00	54.00				52.00	59.00	54.00
	75th Percentile	67.00	79.00	73.00				67.00	79.00	73.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 18-29		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	56	108	164	18	66	84	74	174	248
	Mean	46.27	59.52	53.29	56.47	56.95	56.81	47.12	59.10	53.74
	Standard Deviation	36.41	43.39	43.25	29.22	21.54	23.20	35.17	36.62	37.68
	Minimum Observed	17.00	14.00	14.00	23.00	21.00	21.00	17.00	14.00	14.00
	25th Percentile	37.00	39.00	38.00	41.00	39.00	39.00	37.00	39.00	38.00
	50th Percentile (Median)	45.00	54.00	51.00	54.00	55.00	55.00	45.00	54.00	52.00
	75th Percentile	54.00	77.00	64.00	74.00	68.00	68.00	54.00	77.00	64.00
	Maximum Observed	100.00	100.00	100.00	99.00	99.00	99.00	100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 30-39		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	54	145	199	21	68	89	75	213	288
	Mean	51.64	58.33	55.97	53.58	53.62	53.61	51.85	57.77	55.70
	Standard Deviation	43.33	37.80	39.63	23.95	17.80	19.27	38.74	32.79	34.62
	Minimum Observed	12.00	7.00	7.00	24.00	13.00	13.00	12.00	7.00	7.00
	25th Percentile	32.00	39.00	36.00	40.00	37.00	38.00	32.00	38.00	36.00
	50th Percentile (Median)	53.00	54.00	54.00	52.00	54.00	54.00	53.00	54.00	54.00
	75th Percentile	59.00	78.00	74.00	58.00	60.00	59.00	59.00	77.00	72.00
	Maximum Observed	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 40-49		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	61	114	175	29	35	64	90	149	239
	Mean	43.93	53.60	49.42	48.72	55.05	51.48	44.53	53.71	49.62
	Standard Deviation	39.29	40.36	40.89	21.36	17.73	19.57	34.54	36.28	36.40
	Minimum Observed	4.00	9.00	4.00	18.00	28.00	18.00	4.00	9.00	4.00
	25th Percentile	35.00	37.00	35.00	37.00	38.00	37.00	35.00	37.00	36.00
	50th Percentile (Median)	41.00	53.00	51.00	42.00	54.00	51.00	41.00	53.00	51.00
	75th Percentile	55.00	63.00	59.00	57.00	63.00	58.00	56.00	63.00	59.00
	Maximum Observed	89.00	100.00	100.00	99.00	99.00	99.00	99.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 50-59		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	57	83	140	23	22	45	80	105	185
	Mean	46.80	51.77	49.12	47.47	49.45	48.22	46.87	51.60	49.04
	Standard Deviation	48.71	39.82	43.80	25.35	23.12	24.04	43.14	36.87	39.85
	Minimum Observed	4.00	6.00	4.00	9.00	6.00	6.00	4.00	6.00	4.00
	25th Percentile	34.00	37.00	36.00	36.00	37.00	36.00	35.00	37.00	36.00
	50th Percentile (Median)	49.00	53.00	51.00	45.00	54.00	48.00	49.00	53.00	51.00
	75th Percentile	55.00	58.00	56.00	54.00	56.00	56.00	55.00	58.00	56.00
	Maximum Observed	97.00	100.00	100.00	100.00	99.00	100.00	100.00	100.00	100.00

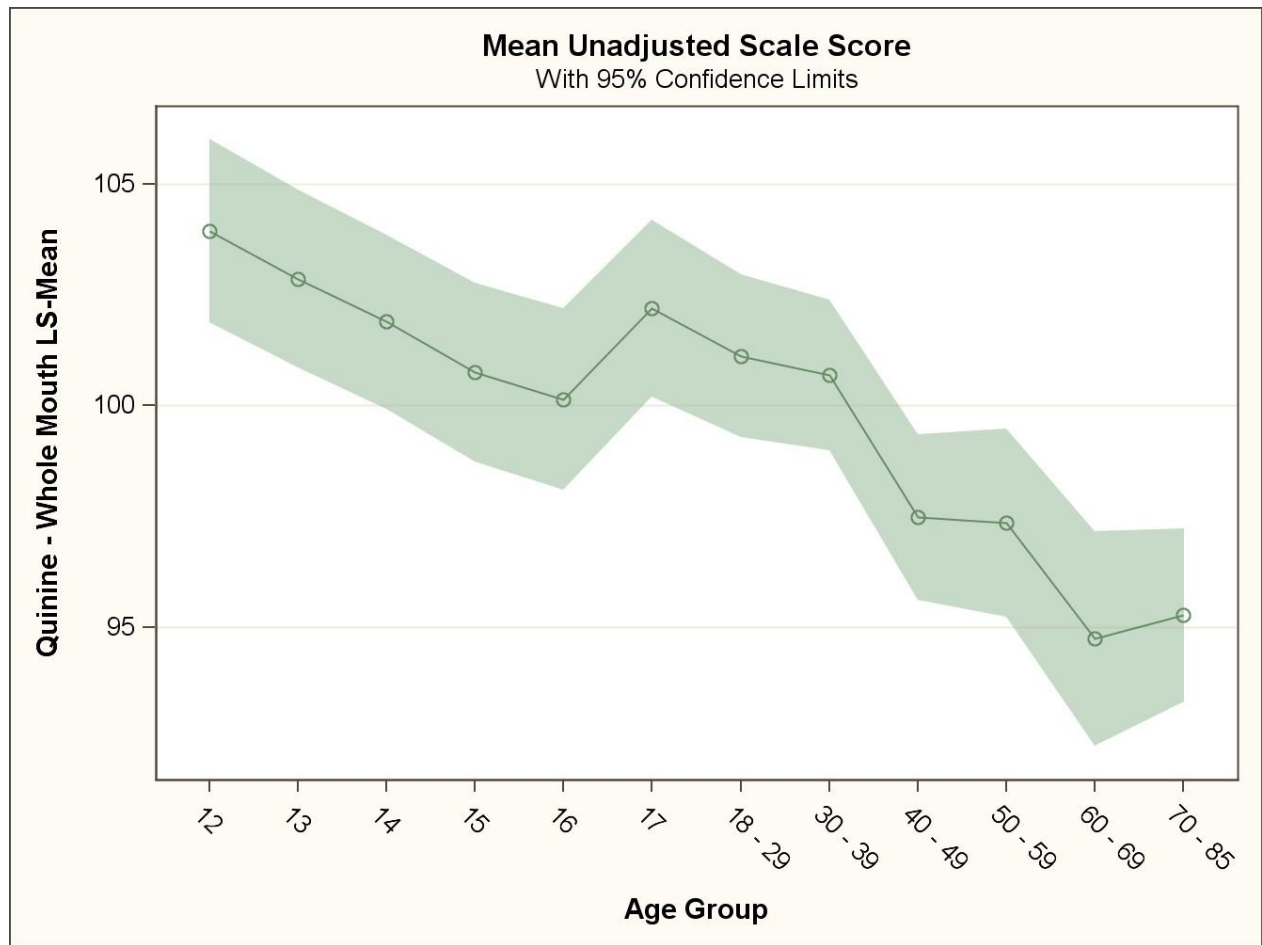
Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 60-69		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	46	67	113	16	14	30	62	81	143
	Mean	42.81	47.38	45.02	44.27	50.20	46.36	42.93	47.52	45.11
	Standard Deviation	46.18	37.72	41.41	13.31	8.86	11.62	40.22	34.46	37.15
	Minimum Observed	6.00	1.00	1.00	28.00	35.00	28.00	6.00	1.00	1.00
	25th Percentile	31.00	35.00	32.00	36.00	40.00	36.00	31.00	36.00	32.00
	50th Percentile (Median)	39.00	52.00	44.00	40.00	53.00	47.00	39.00	52.00	44.00
	75th Percentile	56.00	56.00	56.00	54.00	56.00	55.00	56.00	56.00	56.00
	Maximum Observed	100.00	95.00	100.00	68.00	72.00	72.00	100.00	95.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – Age 70-85		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	93	99	192	16	12	28	109	111	220
	Mean	44.11	49.88	46.52	43.21	55.72	47.57	44.07	50.05	46.55
	Standard Deviation	29.07	28.35	28.88	10.28	13.52	12.23	27.11	27.12	27.31
	Minimum Observed	2.00	3.00	2.00	5.00	35.00	5.00	2.00	3.00	2.00
	25th Percentile	34.00	35.00	35.00	34.00	37.00	36.00	34.00	36.00	35.00
	50th Percentile (Median)	39.00	53.00	43.00	43.00	55.00	47.00	39.00	53.00	43.00
	75th Percentile	54.00	58.00	56.00	56.00	56.00	56.00	54.00	58.00	56.00
	Maximum Observed	100.00	100.00	100.00	60.00	98.00	98.00	100.00	100.00	100.00

<b>Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – NCS Sample of Mothers</b>		<b>English</b>	<b>Spanish</b>	<b>All</b>
	N	74	34	108
	Mean	52.72	53.35	52.92
	Standard Deviation	24.09	17.75	22.21
	Minimum Observed	7.00	13.00	7.00
	25th Percentile	35.00	39.00	37.00
	50th Percentile (Median)	52.00	54.50	53.00
	75th Percentile	72.00	60.00	68.50
	Maximum Observed	100.00	98.00	100.00

<b>Table 2. NIH Toolbox Regional Taste Intensity Test - Quinine Whole Mouth (0-100) – NCS Sample of Pregnant Women</b>		<b>English</b>	<b>Spanish</b>	<b>All</b>
	N	75	30	105
	Mean	56.83	51.77	55.38
	Standard Deviation	24.12	20.58	23.18
	Minimum Observed	7.00	21.00	7.00
	25th Percentile	36.00	36.00	36.00
	50th Percentile (Median)	53.00	49.50	53.00
	75th Percentile	77.00	57.00	74.00
	Maximum Observed	100.00	99.00	100.00

Figure 1  
Least Squares Means



## Section 11: Measure Norms-Salt

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

**Table 1.** Salt Whole Mouth Score, Unadjusted Scale Score, and Fully Adjusted Scale Score Summary (N, Mean, Standard Deviation) by Age Group (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

**Table 2.** Salt Whole Mouth Score Statistics (N, Mean, Standard Deviation, Minimum/Maximum Observed, 25<sup>th</sup>/50<sup>th</sup>/75<sup>th</sup> Percentile) per Age Group (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85, All)

**Figure 1.** Salt Mean Unadjusted Scale Scores across All Age Groups (12, 13, 14, 15, 16, 17, 18-29, 30-39, 40-49, 50-59, 60-69, 70-85)

Table 1. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth by Age Group	Regional Taste Intensity Test - Salt Whole Mouth (0-100)			Salt - Whole Mouth Unadjusted Scale Score			Salt - Whole Mouth Fully Adjusted Scale Score		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Age Group									
3	0			0			0		
4	0			0			0		
5	0			0			0		
6	0			0			0		
7	0			0			0		
8	0			0			0		
9	0			0			0		
10	0			0			0		
11	0			0			0		
12	193	47.06	14.09	193	103.02	9.76	184	98.27	10.33
13	208	40.52	12.28	208	98.99	8.82	200	99.59	8.82
14	215	42.77	11.67	215	100.90	7.99	208	99.65	7.97
15	204	39.28	11.15	204	98.74	7.92	199	100.24	7.86
16	199	42.55	11.69	199	101.24	7.77	190	100.08	7.88
17	211	45.07	13.07	211	102.22	8.51	204	98.95	9.17
18 - 29	246	40.95	40.69	246	99.35	27.57	239	99.51	27.09
30 - 39	287	41.31	31.60	287	99.90	21.62	277	99.74	22.00
40 - 49	239	40.79	36.09	239	99.59	24.12	227	100.08	24.23
50 - 59	185	38.05	37.36	185	97.94	27.38	171	100.68	26.72
60 - 69	144	39.29	35.58	144	98.66	24.61	139	100.17	24.37
70 - 85	218	38.95	23.13	218	98.77	16.80	197	100.77	16.33
All	2549	40.30	26.23	2549	99.25	18.11	2435	100.02	17.98

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 12		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	92	101	193	0	0	0	92	101	193
	Mean	48.68	44.89	47.06				48.68	44.89	47.06
	Standard Deviation	14.53	13.68	14.09				14.53	13.68	14.09
	Minimum Observed	2.00	4.00	2.00				2.00	4.00	2.00
	25th Percentile	34.00	26.00	27.00				34.00	26.00	27.00
	50th Percentile (Median)	50.00	38.00	44.00				50.00	38.00	44.00
	75th Percentile	61.00	60.00	60.00				61.00	60.00	60.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 13		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	113	95	208	0	0	0	113	95	208
	Mean	41.65	38.34	40.52				41.65	38.34	40.52
	Standard Deviation	13.57	10.54	12.28				13.57	10.54	12.28
	Minimum Observed	6.00	4.00	4.00				6.00	4.00	4.00
	25th Percentile	25.00	20.00	25.00				25.00	20.00	25.00
	50th Percentile (Median)	37.00	37.00	37.00				37.00	37.00	37.00
	75th Percentile	53.00	52.00	53.00				53.00	52.00	53.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 14		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	106	109	215	0	0	0	106	109	215
	Mean	40.14	46.76	42.77				40.14	46.76	42.77
	Standard Deviation	11.69	11.45	11.67				11.69	11.45	11.67
	Minimum Observed	5.00	5.00	5.00				5.00	5.00	5.00
	25th Percentile	26.00	29.00	27.00				26.00	29.00	27.00
	50th Percentile (Median)	38.00	44.00	39.00				38.00	44.00	39.00
	75th Percentile	53.00	57.00	55.00				53.00	57.00	55.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 15		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	100	104	204	0	0	0	100	104	204
	Mean	38.04	40.93	39.28				38.04	40.93	39.28
	Standard Deviation	12.29	9.93	11.15				12.29	9.93	11.15
	Minimum Observed	7.00	1.00	1.00				7.00	1.00	1.00
	25th Percentile	24.00	28.00	25.00				24.00	28.00	25.00
	50th Percentile (Median)	36.00	37.00	36.00				36.00	37.00	36.00
	75th Percentile	48.00	53.00	52.00				48.00	53.00	52.00
	Maximum Observed	99.00	100.00	100.00				99.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 16		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	100	99	199	0	0	0	100	99	199
	Mean	43.61	41.00	42.55				43.61	41.00	42.55
	Standard Deviation	12.34	11.01	11.69				12.34	11.01	11.69
	Minimum Observed	11.00	12.00	11.00				11.00	12.00	11.00
	25th Percentile	29.00	22.00	26.00				29.00	22.00	26.00
	50th Percentile (Median)	41.00	38.00	39.00				41.00	38.00	39.00
	75th Percentile	55.00	54.00	54.00				55.00	54.00	54.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 17		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	107	104	211	0	0	0	107	104	211
	Mean	43.66	47.49	45.07				43.66	47.49	45.07
	Standard Deviation	13.15	12.97	13.07				13.15	12.97	13.07
	Minimum Observed	5.00	6.00	5.00				5.00	6.00	5.00
	25th Percentile	27.00	27.00	27.00				27.00	27.00	27.00
	50th Percentile (Median)	41.00	44.00	42.00				41.00	44.00	42.00
	75th Percentile	53.00	67.00	56.00				53.00	67.00	56.00
	Maximum Observed	100.00	100.00	100.00				100.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 18-29		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	56	108	164	17	65	82	73	173	246
	Mean	34.96	46.24	40.94	48.64	38.05	41.04	36.06	44.90	40.95
	Standard Deviation	42.28	46.29	46.32	34.90	23.10	26.28	41.29	39.44	40.69
	Minimum Observed	6.00	4.00	4.00	20.00	6.00	6.00	6.00	4.00	4.00
	25th Percentile	20.00	27.00	24.00	25.00	19.00	22.00	20.00	26.00	24.00
	50th Percentile (Median)	33.00	39.00	36.00	37.00	37.00	37.00	35.00	39.00	36.00
	75th Percentile	47.00	59.00	53.00	59.00	54.00	55.00	47.00	58.00	53.00
	Maximum Observed	88.00	100.00	100.00	99.00	99.00	99.00	99.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 30-39		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	54	145	199	21	67	88	75	212	287
	Mean	41.78	41.73	41.75	39.99	36.93	37.96	41.58	41.16	41.31
	Standard Deviation	40.26	34.28	35.90	21.93	17.29	18.41	35.94	30.01	31.60
	Minimum Observed	3.00	2.00	2.00	18.00	5.00	5.00	3.00	2.00	2.00
	25th Percentile	25.00	27.00	26.00	25.00	21.00	22.00	25.00	26.00	25.00
	50th Percentile (Median)	39.00	38.00	39.00	37.00	36.00	36.00	39.00	38.00	38.00
	75th Percentile	54.00	52.00	53.00	53.00	52.00	52.00	54.00	52.00	53.00
	Maximum Observed	99.00	100.00	100.00	99.00	99.00	99.00	99.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 40-49		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	61	115	176	29	34	63	90	149	239
	Mean	40.39	41.37	40.95	37.49	41.63	39.27	40.03	41.39	40.79
	Standard Deviation	41.30	39.99	40.34	21.11	19.28	20.09	35.97	36.26	36.09
	Minimum Observed	9.00	10.00	9.00	17.00	7.00	7.00	9.00	7.00	7.00
	25th Percentile	24.00	24.00	24.00	21.00	30.00	26.00	24.00	24.00	24.00
	50th Percentile (Median)	37.00	36.00	37.00	36.00	37.00	36.00	37.00	37.00	37.00
	75th Percentile	53.00	54.00	53.00	42.00	46.00	46.00	53.00	53.00	53.00
	Maximum Observed	96.00	100.00	100.00	97.00	100.00	100.00	97.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 50-59		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	57	83	140	23	22	45	80	105	185
	Mean	40.74	35.64	38.37	35.06	34.31	34.78	40.16	35.54	38.05
	Standard Deviation	48.73	36.03	41.85	19.28	14.61	16.97	42.44	32.67	37.36
	Minimum Observed	14.00	1.00	1.00	12.00	12.00	12.00	12.00	1.00	1.00
	25th Percentile	25.00	20.00	23.00	20.00	20.00	20.00	25.00	20.00	22.00
	50th Percentile (Median)	38.00	35.00	36.00	35.00	37.00	35.00	38.00	35.00	36.00
	75th Percentile	53.00	49.00	52.00	44.00	41.00	42.00	53.00	48.00	52.00
	Maximum Observed	100.00	99.00	100.00	69.00	70.00	70.00	100.00	99.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 60-69		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	46	68	114	16	14	30	62	82	144
	Mean	39.08	39.88	39.47	40.14	30.60	36.78	39.17	39.43	39.29
	Standard Deviation	38.75	38.68	38.55	26.62	11.28	21.09	35.81	35.61	35.58
	Minimum Observed	11.00	7.00	7.00	6.00	17.00	6.00	6.00	7.00	6.00
	25th Percentile	27.00	21.00	25.00	18.00	18.00	18.00	27.00	21.00	24.00
	50th Percentile (Median)	36.00	36.00	36.00	37.00	32.50	36.00	36.00	36.00	36.00
	75th Percentile	46.00	54.00	53.00	56.00	39.00	47.00	46.00	54.00	53.00
	Maximum Observed	98.00	100.00	100.00	83.00	57.00	83.00	98.00	100.00	100.00

Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – Age 70-85		English			Spanish			Total		All
		Males	Females	Total	Males	Females	Total	Males	Females	
	N	92	99	191	15	12	27	107	111	218
	Mean	39.45	37.94	38.82	42.79	43.00	42.86	39.58	38.09	38.95
	Standard Deviation	24.72	23.88	24.25	14.81	10.03	12.67	23.54	22.79	23.13
	Minimum Observed	5.00	3.00	3.00	18.00	18.00	18.00	5.00	3.00	3.00
	25th Percentile	29.00	20.00	27.00	24.00	32.00	25.00	28.00	20.00	27.00
	50th Percentile (Median)	36.00	36.00	36.00	43.00	53.00	43.00	36.00	36.00	36.00
	75th Percentile	50.00	54.00	51.00	60.00	53.00	55.00	51.00	54.00	52.00
	Maximum Observed	98.00	99.00	99.00	76.00	78.00	78.00	98.00	99.00	99.00

<b>Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – NCS Sample of Mothers</b>		<b>English</b>	<b>Spanish</b>	<b>All</b>
	N	75	34	109
	Mean	40.93	36.56	39.57
	Standard Deviation	22.51	22.18	22.40
	Minimum Observed	2.00	6.00	2.00
	25th Percentile	26.00	20.00	21.00
	50th Percentile (Median)	36.00	35.50	36.00
	75th Percentile	52.00	40.00	48.00
	Maximum Observed	99.00	98.00	99.00

<b>Table 2. NIH Toolbox Regional Taste Intensity Test - Salt Whole Mouth (0-100) – NCS Sample of Pregnant Women</b>		<b>English</b>	<b>Spanish</b>	<b>All</b>
	N	75	30	105
	Mean	41.55	36.53	40.11
	Standard Deviation	22.06	21.04	21.79
	Minimum Observed	8.00	8.00	8.00
	25th Percentile	26.00	18.00	22.00
	50th Percentile (Median)	37.00	36.00	36.00
	75th Percentile	53.00	55.00	53.00
	Maximum Observed	100.00	99.00	100.00

Figure 1  
Least Squares Means

