



COGNITIVE FUNCTION SCORING MANUAL

A brief guide to scoring the PROMIS® Cognitive Function instruments:

ADULT	PEDIATRIC	PARENT PROXY
PROMIS Item Bank v1.0 – Applied Cognition - Abilities*	PROMIS Pediatric Item Bank v1.0 – Cognitive Function	PROMIS Parent Proxy Item Bank v1.0 – Cognitive Function*
PROMIS Item Bank v1.0 – Applied Cognition - General Concerns*	PROMIS Pediatric Short Form v1.0 – Cognitive Function 7a	PROMIS Parent Proxy Short Form v1.0 – Cognitive Function 7a
PROMIS Short Form v1.0 – Applied Cognition - Abilities 4a*		PROMIS Parent Proxy Item Bank v1.1 – Cognitive Function
PROMIS Short Form v1.0 – Applied Cognition - General Concerns 4a*		PROMIS Parent Proxy Short Form v1.1 – Cognitive Function 7a
PROMIS Short Form v1.0 – Applied Cognition - Abilities 6a*		
PROMIS Short Form v1.0 – Applied Cognition - General Concerns 6a*		
PROMIS Short Form v1.0 – Applied Cognition - Abilities 8a*		
PROMIS Short Form v1.0 – Applied Cognition - General Concerns 8a*		
PROMIS Item Bank v2.0 – Cognitive Function Abilities Subset		
PROMIS Short Form v2.0 – Cognitive Function 4a		
PROMIS Short Form v2.0 – Cognitive Function Abilities Subset 4a		
PROMIS Short Form v2.0 – Cognitive Function 6a		
PROMIS Short Form v2.0 – Cognitive Function Abilities Subset 6a		
PROMIS Short Form v2.0 – Cognitive Function 8a		
PROMIS Short Form v2.0 – Cognitive Function Abilities Subset 8a		

*Retired measure

COMPARING SCORES ACROSS VERSIONS

Some PROMIS domains have multiple versions of instruments (i.e. v1.0, v1.1, v2.0). Generally, **it is recommended that you use the most recent version available which can be identified as the instruments with the highest version number.** In most cases, an instrument that has a decimal increase (v1.0 to v1.1) retains the same item-level parameters as well as instrument reliability and validity. In cases where a version number increases by a whole number (e.g., v1.0 to v2.0), the changes to the instrument are more substantial.

Adult

Several changes were made to the v1.0 Applied Cognition – General Concerns measures to produce v2.0 Cognitive Function measures. The scoring direction was reversed so that in v2.0, higher scores represent better cognitive function. A new item bank (v2.0) was created as items were re-calibrated to reflect the new item set as well as the new scoring direction. The PROMIS Bank v2.0 – Cognitive Function can be administered as a computer adaptive test or with a 4-, 6-, or 8-item short form. PROMIS v1.0 Applied Cognition – General Concerns T-scores cannot be compared to PROMIS v2.0 Cognitive Function scores. Instructions for converting



PROMIS v1.0 Applied Cognition – General Concerns to the v2.0 Cognitive Function metric to enable comparisons across versions are below.

PROMIS v2.0 Cognitive Function- Abilities Subset was an improvement from v1.0 Applied Cognition – Abilities. Specifically, two items (PC24 & PC-CaPS7) demonstrating local dependency to other items were removed, resulting a total of 31 items. The scoring direction stayed the same as the v1.0 instrument. A new item bank was created as items were re-calibrated. PROMIS v1.0 Applied Cognition – Abilities T-scores cannot be compared to PROMIS v2.0 Cognitive Function – Abilities Subset scores. Instructions for converting PROMIS v1.0 Applied Cognition – Abilities to the v2.0 Cognitive Function – Abilities Subset metric to enable comparisons across versions are below.

Reference: Lai, J-S., Wagner, L.I., Jacobsen, P.B., Cella, D. (2014). Self-reported Cognitive Concerns and Abilities: Two sides of one coin? Psycho-Oncology. 23(10):1133-41

Pediatric and Parent Proxy

Use the scoring table (v1.0 or v1.1) that corresponds to the version of the measure used.

SCORING THE INSTRUMENT

Short Forms: PROMIS instruments are scored using item-level calibrations. This means that the most accurate way to score a PROMIS instrument is to use the HealthMeasures Scoring Service (https://www.assessmentcenter.net/ac_scoringervice) or a data collection tool that automatically calculates scores (e.g., REDCap auto-score). This method of scoring uses responses to each item for each participant. We refer to this as “response pattern scoring.” Because response pattern scoring is more accurate than the use of raw score/scale score look up tables included in this manual, it is preferred. Response pattern scoring is especially useful when there is missing data (i.e., a respondent skipped an item), different groups of participants responded to different items, or you have created a new questionnaire using a subset of questions from a PROMIS item bank.

Each question usually has five response options ranging in value from one to five. To find the total raw score for a short form with all questions answered, sum the values of the response to each question. For example, for the adult 8-item short form, the lowest possible raw score is 8; the highest possible raw score is 40 (see all short form scoring tables in Appendix 1). **All questions must be answered in order to produce a valid score using the scoring tables.** If a participant has skipped a question, use the HealthMeasures Scoring Service (https://www.assessmentcenter.net/ac_scoringervice) to generate a final score.

Locate the applicable score conversion table in Appendix 1 and use this table to translate the total raw score into a T-score for each participant. The T-score rescales the raw score into a standardized score with a mean of 50 and a standard deviation (SD) of 10. Therefore, a person with a T-score of 40 is one SD below the mean.

For the adult PROMIS v2.0 Adult Cognitive Function 4a short form, a raw score of 10 converts to a T-score of 37.69 with a standard error (SE) of 2.98 (see scoring table for the 4a short form in Appendix 1). Thus, the 95% confidence interval around the observed score ranges from 31.8 to 43.53 (T-score \pm (1.96*SE) or 37.69 \pm (1.96*2.98)).

Converting v1.0 Measures to the v2.0 Metric

- The v1.0 Applied Cognition short forms should be scored as v2.0 Cognitive Function measures. To do this: For PROMIS v1.0 Applied Cognition – General Concerns short forms, flip the direction of scores so

that Never = 5 and Very often (several times a day) = 1. Amend the item IDs with an “r”. You can see the correct item IDs and response scores in a PDF of a v2.0 Cognitive Function measure PDF. Then, follow the usual scoring instructions and the Cognitive Function v2.0 short form look-up table in this manual. When writing about the measure, it should be described as a Cognitive Function v2.0.

- For PROMIS v1.0 Applied Cognition – Abilities, retain the v1.0 response scores. Use the Cognitive Function – Abilities subset short form look-up table in this manual. When writing about the measure, it should be described as a Cognitive Function – Abilities Subset v2.0.

CAT: A minimum number of items (4 for adult CATs and 5 for peds and parent proxy CATs) must be answered in order to receive a score for the cognitive function CATs. The response to the first item will guide the system’s choice of the next item for the participant. The participant’s response to the second item will dictate the selection of the following question, and so on. As additional items are administered, the potential for error is reduced and confidence in the respondent’s score increases. The CAT will continue until either the standard error drops below a specified level (on the T-score metric 3.0 for adult CATs and 4.0 for peds and parent proxy CATs), or the participant has answered the maximum number of questions (12), whichever occurs first.

SCORES

For most PROMIS instruments, a score of 50 is the average for the United States general population with a standard deviation of 10 because calibration testing was performed on a large sample of the general population. You can read more about the calibration and centering samples at HealthMeasures.net in the Interpret PROMIS (<http://www.healthmeasures.net/score-and-interpret/interpret-scores/promis>) section. The T-score is provided with an error term (Standard Error or SE). The Standard Error is a statistical measure of variance and represents the “margin of error” for the T-score.

Important: A higher PROMIS T-score represents more of the concept being measured. For concepts like cognitive function (v2.0), a T-score of 60 is one SD better than average. By comparison cognitive function T-score of 40 is one SD worse than average.

Standard Error (SE): A PROMIS score includes a T-score and a standard error (SE). The standard error is a measure of the variability for a given T-score across hypothetical repeated measurements. The standard error can be used to construct confidence intervals around a T-score. A 95% confidence interval is common. A 95% confidence interval means there is a 95% probability that the true T-score is within this range. The formula for a 95% confidence interval is $(T\text{-score} \pm (1.96 * SE))$. For example, if $T=52$ and $SE=2$, the lower boundary of the confidence interval is $(52 - (1.96 * 2)) = 48$ and the upper boundary is $(52 + (1.96 * 2)) = 56$.

FREQUENTLY ASKED QUESTIONS (FAQs)

Q: I am interested in learning more. Where can I do that?

Review the HealthMeasures website at www.healthmeasures.net.

Q: How do I handle multiple responses when administering a short form on paper?

Guidelines on how to deal with multiple responses have been established. Resolution depends on the responses noted by the research participant.

- If two or more responses are marked by the respondent, and they are next to one another, then a data entry specialist will be responsible for randomly selecting one of them to be entered and will write down on the form which answer was selected. Note: To randomly select one of two responses, the data entry



specialist will flip a coin (heads - higher number will be entered; tails – lower number will be entered). To randomly select one of three (or more) responses, a table of random numbers should be used with a statistician's assistance.

- If two or more responses are marked, and they are NOT all next to one another, the response will be considered missing.

Q: What is the minimum change on a PROMIS instrument that represents a clinically meaningful difference? To learn more about research on the meaning of a change in scores, we suggest conducting a literature review to identify the most current information. The HealthMeasures website (<http://www.healthmeasures.net/score-and-interpret/interpret-scores/promis>) has additional information on interpreting scores.

APPENDIX 1 – SCORING TABLES

Adult v2.0 - Cognitive Function 4a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
4	24.99	4.41
5	28.95	3.39
6	31.07	3.22
7	32.94	3.07
8	34.61	3.01
9	36.17	2.98
10	37.69	2.98
11	39.19	2.99
12	40.70	3.00
13	42.25	3.02
14	43.86	3.04
15	45.54	3.07
16	47.33	3.14
17	49.28	3.24
18	51.62	3.51
19	54.58	3.89
20	61.13	5.96
*SE= Standard Error on T-score metric		

Adult v2.0 - Cognitive Function 6a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
6	23.13	4.25
7	26.64	3.28
8	28.55	3.05
9	30.18	2.84
10	31.58	2.72
11	32.85	2.64
12	34.04	2.59
13	35.17	2.57
14	36.28	2.57
15	37.37	2.57
16	38.45	2.57
17	39.53	2.58
18	40.63	2.59
19	41.74	2.60
20	42.87	2.62
21	44.04	2.63
22	45.23	2.64
23	46.47	2.67
24	47.77	2.71
25	49.17	2.79
26	50.72	2.94
27	52.49	3.14
28	54.69	3.51
29	57.60	4.04
30	63.17	5.75
*SE= Standard Error on T-score metric		

Adult v2.0 - Cognitive Function 8a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
8	22.41	4.10
9	25.73	3.10
10	27.45	2.85
11	28.90	2.60
12	30.11	2.45
13	31.18	2.34
14	32.15	2.26
15	33.06	2.21
16	33.92	2.18
17	34.75	2.16
18	35.56	2.15
19	36.36	2.15
20	37.15	2.15
21	37.93	2.15
22	38.71	2.16
23	39.50	2.16
24	40.29	2.17
25	41.09	2.18
26	41.90	2.19
27	42.72	2.19
28	43.57	2.20
29	44.43	2.21
30	45.31	2.23
31	46.22	2.25
32	47.17	2.28
33	48.18	2.33
34	49.26	2.40
35	50.45	2.51
36	51.80	2.70
37	53.36	2.93
38	55.36	3.34
39	58.08	3.91
40	63.48	5.65
*SE= Standard Error on T-score metric		

Adult v2.0 - Cognitive Function Abilities Subset 4a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
4	26.56	4.76
5	30.70	3.83
6	33.24	3.60
7	35.36	3.45
8	37.26	3.37
9	39.03	3.33
10	40.73	3.32
11	42.41	3.33
12	44.09	3.34
13	45.81	3.37
14	47.59	3.39
15	49.45	3.41
16	51.43	3.45
17	53.59	3.54
18	56.12	3.71
19	59.29	4.08
20	64.86	5.53
*SE= Standard Error on T-score metric		

Adult v2.0 - Cognitive Function Abilities Subset 6a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
6	24.50	4.53
7	28.03	3.66
8	30.31	3.34
9	32.11	3.16
10	33.71	3.02
11	35.15	2.92
12	36.48	2.87
13	37.74	2.84
14	38.96	2.83
15	40.15	2.82
16	41.33	2.82
17	42.51	2.83
18	43.69	2.85
19	44.89	2.87
20	46.11	2.89
21	47.37	2.91
22	48.65	2.93
23	49.98	2.95
24	51.38	2.99
25	52.87	3.06
26	54.53	3.18
27	56.38	3.35
28	58.51	3.57
29	61.31	4.03
30	66.16	5.38
*SE= Standard Error on T-score metric		

Adult v2.0 - Cognitive Function Abilities Subset 8a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
8	23.27	4.36
9	26.59	3.47
10	28.63	3.13
11	30.23	2.93
12	31.63	2.76
13	32.87	2.64
14	34.01	2.56
15	35.07	2.51
16	36.07	2.48
17	37.04	2.46
18	37.97	2.45
19	38.90	2.44
20	39.81	2.44
21	40.71	2.44
22	41.61	2.45
23	42.51	2.46
24	43.42	2.46
25	44.34	2.48
26	45.27	2.49
27	46.21	2.50
28	47.18	2.52
29	48.16	2.53
30	49.17	2.55
31	50.21	2.56
32	51.29	2.59
33	52.42	2.63
34	53.63	2.68
35	54.94	2.78
36	56.39	2.93
37	58.03	3.14
38	59.95	3.41
39	62.52	3.90
40	67.09	5.24
*SE= Standard Error on T-score metric		

Pediatric v1.0 - Cognitive Function 7a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
7	24.01	3.98
8	27.66	2.72
9	29.47	2.42
10	30.9	2.23
11	32.11	2.11
12	33.18	2.04
13	34.18	1.99
14	35.11	1.97
15	36.01	1.95
16	36.89	1.95
17	37.76	1.94
18	38.62	1.95
19	39.47	1.95
20	40.33	1.95
21	41.19	1.95
22	42.07	1.96
23	42.96	1.97
24	43.88	1.99
25	44.83	2.01
26	45.82	2.03
27	46.84	2.04
28	47.90	2.06
29	49.02	2.08
30	50.22	2.11
31	51.54	2.17
32	53.02	2.30
33	54.79	2.57
34	57.26	3.13
35	63.09	5.40
*SE= Standard Error on T-score metric		

Parent Proxy v1.1 - Cognitive Function 7a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
7	22.3	3.9
8	25.9	2.8
9	27.8	2.5
10	29.3	2.3
11	30.6	2.2
12	31.8	2.1
13	32.9	2.1
14	34.0	2.1
15	35.0	2.1
16	35.9	2.1
17	36.9	2.1
18	37.8	2.0
19	38.7	2.0
20	39.7	2.0
21	40.6	2.0
22	41.5	2.0
23	42.4	2.1
24	43.4	2.1
25	44.4	2.1
26	45.4	2.1
27	46.5	2.1
28	47.6	2.2
29	48.7	2.2
30	50.0	2.2
31	51.3	2.3
32	52.9	2.4
33	54.7	2.7
34	57.2	3.2
35	63.0	5.4
*SE= Standard Error on T-score metric		

APPENDIX 2 – SCORING TABLES FOR RETIRED MEASURES

Adult v1.0 - Applied Cognition - General Concerns 4a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
4	26.2	4.0
5	30.4	2.7
6	32.3	2.5
7	34.0	2.3
8	35.5	2.3
9	36.9	2.3
10	38.4	2.3
11	39.9	2.3
12	41.4	2.3
13	43.0	2.3
14	44.7	2.3
15	46.3	2.3
16	48.0	2.3
17	49.7	2.4
18	51.7	2.6
19	54.3	3.0
20	61.1	5.7
*SE= Standard Error on T-score metric		

Adult v1.0 - Applied Cognition - General Concerns 6a		
<i>Short Form Conversion Table</i>		
Raw Score	T -Score	SE*
6	24.8	3.9
7	28.5	2.6
8	30.4	2.3
9	31.8	2.1
10	33.1	2.0
11	34.2	2.0
12	35.3	1.9
13	36.3	1.9
14	37.3	2.0
15	38.4	2.0
16	39.4	2.0
17	40.5	2.0
18	41.6	2.0
19	42.7	2.0
20	43.9	2.0
21	45.0	2.0
22	46.1	2.0
*SE= Standard Error on T-score metric		

Adult v1.0 - Applied Cognition - General Concerns 8a					
<i>Short Form Conversion Table</i>					
Raw Score	T-Score	SE*	Raw Score	T-Score	SE*
8	23.3	3.8	25	41.6	1.8
9	26.8	2.6	26	42.5	1.8
10	28.4	2.3	27	43.3	1.8
11	29.8	2.1	28	44.2	1.8
12	30.9	1.9	29	45.1	1.8
13	31.8	1.8	30	45.9	1.8
14	32.7	1.8	31	46.8	1.8
15	33.6	1.8	32	47.7	1.8
16	34.4	1.7	33	48.6	1.8
17	35.2	1.7	34	49.5	1.8
18	36.0	1.7	35	50.6	1.9
19	36.7	1.7	36	51.7	2.0
20	37.5	1.8	37	53.0	2.1
21	38.3	1.8	38	54.6	2.5
22	39.1	1.8	39	56.8	3.0
23	40.0	1.8	40	62.7	5.4
24	40.8	1.8			
*SE= Standard Error on T-score metric					

Adult v1.0 - Applied Cognition - Abilities 4a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
4	30.1	4.4
5	34.6	2.7
6	36.6	2.4
7	38.2	2.2
8	39.5	2.1
9	40.8	2.1
10	42.2	2.1
11	43.5	2.2
12	44.9	2.2
13	46.4	2.2
14	48.0	2.2
15	49.7	2.2
16	51.4	2.2
17	53.2	2.2
18	55.2	2.4
19	57.8	2.7
20	63.8	5.2
*SE= Standard Error on T-score metric		

Adult v1.0 - Applied Cognition - Abilities 6a		
<i>Short Form Conversion Table</i>		
Raw Score	T -Score	SE*
6	27.4	4.1
7	32.1	2.5
8	34.1	2.1
9	35.5	1.9
10	36.7	1.8
11	37.8	1.7
12	38.7	1.7
13	39.6	1.7
14	40.5	1.7
15	41.5	1.7
16	42.4	1.7
17	43.4	1.8
18	44.4	1.8
19	45.4	1.7
20	46.5	1.7
21	47.6	1.7
22	48.7	1.8
23	49.9	1.8
24	51.0	1.8
25	52.2	1.8
26	53.5	1.8
27	54.8	1.8
28	56.4	2.1
29	58.5	2.6
30	64.1	5.1
*SE= Standard Error on T-score metric		

Adult v1.0 - Applied Cognition - Abilities 8a					
<i>Short Form Conversion Table</i>					
Raw Score	T -Score	SE*	Raw Score	T -Score	SE*
8	27.0	4.0	25	45.1	1.5
9	31.4	2.4	26	45.9	1.5
10	33.3	2.0	27	46.7	1.5
11	34.5	1.8	28	47.5	1.5
12	35.6	1.7	29	48.4	1.5
13	36.5	1.6	30	49.3	1.5
14	37.3	1.5	31	50.1	1.6
15	38.0	1.5	32	51.0	1.6
16	38.7	1.4	33	52.0	1.6
17	39.4	1.4	34	52.9	1.5
18	40.0	1.4	35	53.9	1.6
19	40.7	1.5	36	54.9	1.6
20	41.4	1.5	37	56.0	1.7
21	42.1	1.5	38	57.4	2.0
22	42.8	1.5	39	59.4	2.5
23	43.6	1.5	40	64.8	5.0
24	44.3	1.5			
*SE= Standard Error on T-score metric					

Parent Proxy v1.0 - Cognitive Function 7a		
<i>Short Form Conversion Table</i>		
Raw Score	T-Score	SE*
7	22.3	3.9
8	25.9	2.8
9	27.8	2.5
10	29.3	2.3
11	30.6	2.2
12	31.8	2.1
13	32.9	2.1
14	34.0	2.1
15	35.0	2.1
16	35.9	2.1
17	36.9	2.1
18	37.8	2.0
19	38.7	2.0
20	39.7	2.0
21	40.6	2.0
22	41.5	2.0
23	42.4	2.1
24	43.4	2.1
25	44.4	2.1
26	45.4	2.1
27	46.5	2.1
28	47.6	2.2
29	48.7	2.2
30	50.0	2.2
31	51.3	2.3
32	52.9	2.4
33	54.7	2.7
34	57.2	3.2
35	63.0	5.4
*SE= Standard Error on T-score metric		