

COGNITIVE FUNCTION MEASURE DIFFERENCES

A brief guide to differences between 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 Item Bank v1.0 – Cognitive Function (recommended)	PROMIS Parent Proxy Short Form v1.0 – Cognitive Function 7a
PROMIS Short Form v1.0 – Applied Cognition - Abilities 4a*	PROMIS Pediatric Item Bank v1.0 – Cognitive Function (screen-to-CAT)	PROMIS Parent Proxy Item Bank v1.1 – Cognitive Function
PROMIS Short Form v1.0 – Applied Cognition - General Concerns 4a*	PROMIS Pediatric Short Form v1.0 – Cognitive Function 7a	PROMIS Parent Proxy Item Bank v1.1 – Cognitive Function (recommended)
PROMIS Short Form v1.0 – Applied Cognition - Abilities 6a*		PROMIS Parent Proxy Item Bank v1.1 – Cognitive Function (screen-to-CAT)
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		
PROMIS Item Bank v2.0 – Cognitive Function (recommended)		
PROMIS Item Bank v2.0 – Cognitive Function (screen-to-CAT)		
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

ABOUT COGNITIVE FUNCTION

The PROMIS Cognitive Function and Cognitive Function Abilities Subset item banks assess patient-perceived cognitive deficits. Facets include mental acuity, concentration, verbal and nonverbal memory, verbal fluency, and perceived changes in these cognitive functions. The extent to which cognitive impairments interfere with daily functioning, whether other people observe cognitive impairments, and the impact of cognitive dysfunction on quality of life are also assessed.

The cognitive function instruments are universal rather than disease-specific. Cognitive Function instruments are available for adults (ages 18+), pediatric self-report (ages 8-17) and for parents serving as proxy reporters for their child (youth ages 5-17). Instruments for adults assess cognitive function over 7 days; instruments for pediatric self-report and for parent-proxy report assess cognitive function over 4 weeks.

INTRODUCTION TO ASSESSMENT OPTIONS

There are two administration options for assessing cognitive function: short forms and computer adaptive tests (CATs). When administering a short form, instruct participants to answer all of the items (i.e., questions or statements) presented. With a CAT, participant responses guide the system's choice of subsequent items from the full item bank (32 items in total for the adult Cognitive Function bank and 31 for the adult Cognitive Function Abilities Subset bank). Although items differ across respondents taking a CAT, scores are comparable across participants.

Some administrators may prefer to ask the same question of all respondents or of the same respondent over time, to enable a more direct comparability across people or time. In these cases, or when paper administration is preferred, a short form would be more desirable than a CAT. This guide provides information on all cognitive function short form and CAT instruments.

CAT: A minimum number of items (e.g., 4) must be answered in order to receive a score for the Cognitive Function CAT. 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 (e.g., on the T-score metric 3.0), or the participant has answered the maximum number of questions (e.g., 12), whichever occurs first. For some CATs, specifically "recommended" and "screen-to-CAT" there are additional stopping rules. These include stopping when the standard error isn't improving much or if a respondent is asymptomatic. The exact stopping rules for Cognitive Function CATs are listed below.

CAT versus Short Form: Whether one uses a short form or CAT, the score metric is Item Response Theory (IRT), a family of statistical models that link individual questions to a presumed underlying trait or concept of cognitive function represented by all items in the item bank. When choosing between a CAT and short form, it is useful to consider the demands of computer-based assessment, and the psychological, physical, and cognitive burden placed on respondents as a result of the number of questions asked.

VERSION DIFFERENCES

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

The first version of PROMIS cognition instruments were named PROMIS v1.0 Applied Cognition - General Concerns and PROMIS v1.0 Applied Cognition – Abilities. These item banks assess a person's perception of cognitive function in areas such as concentration, memory, and mental acuity. In 2015, the relationship between the two Applied Cognition v1.0 item banks was re-evaluated (Lai et al 2014). Based on the results, General Concerns and Abilities could be measured using one unidimensional item bank. Yet, results also supported measuring each construct separately. We recommend a conservative approach by measuring and reporting General Concerns and Abilities separately. We therefore recommended two separate but co-calibrated item banks in PROMIS: Cognitive Function (formerly named General Concerns) and Cognitive Function – Abilities subset. These v2.0 banks include different items. Both item banks showed good psychometric

properties and are available for research and clinical purposes. Consequently, PROMIS released v2.0 instruments intended to replace the version 1.0 instruments.

As cognition deficits (rather than cognitive abilities) are commonly used by clinicians for treatment, **PROMIS recommends Cognitive Function v2.0 as the primary measure.** PROMIS v2.0 Cognitive Function is an improvement from v1.0 Applied Cognition – General Concerns. Specifically, two items (PC15 & PC16) demonstrating local dependency to other items were removed, resulting a total of 32 items. The scoring direction was reversed so that in v2.0, higher scores represent better cognitive function. A new item bank 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 in the Cognitive Function Scoring Manual.

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 in the Cognitive Function Scoring Manual.

Standard, Recommended, and Screen-to-CAT Stopping Rules: The standard, recommended, and screen-to-CAT Adult Cognitive Function computer adaptive tests are based on the exact same item banks, but utilize different stopping rules. The PROMIS Bank v2.0 – Cognitive Function measure is administered by default as a computer adaptive test using the following standard stopping rules:

- Minimum number of items administered = 4
- Stop when one of these occurs:
 - 12 items are administered OR
 - Standard error is below 0.3 on the theta metric (3.0 on the T-score metric)

The PROMIS Bank v2.0 – Cognitive Function (recommended) measure uses the following stopping rules:

- Minimum number of items administered = 4
- Stop when one of these occurs:
 - 8 items are administered OR
 - Standard error is below 0.3 on the theta metric (3.0 on the T-score metric) OR
 - Standard error changes by less than 0.01 on the theta metric (0.1 on the T-score metric)

The PROMIS Bank v2.0 – Cognitive Function (screen-to-CAT) measure uses the following stopping rules:

- If the response to the first item is the “healthiest” response then stop.
- If the response to the first item is NOT the “healthiest” response, proceed with the “recommended” CAT stopping rules.

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

The PROMIS v1.0 pediatric and parent proxy instruments were initially developed via an R01 grant from the National Cancer Institute. It was published with the name Pediatric Perceived Cognitive Function (PedsPCF). The measures were renamed “PROMIS Cognitive Function.” PedsPCF and PROMIS Pediatric Cognitive Function measures are identical. The following publications describe the development of these measures.

PROMIS Parent Proxy Bank v1.1 - Cognitive Function replaced PROMIS Parent Proxy Bank v1.0 - Cognitive Function. The v1.0 measure included an incorrect item stem with item NQCOG62_2Ar. This error was removed in v1.1 with the creation of item NQCOG62_2Ar2. Use the scoring tables (v1.0 or v1.1) that correspond to the version of the measure used. T-scores from v1.0 and v1.1 are comparable.

Standard, Recommended, and Screen-to-CAT Stopping Rules: The standard, recommended, and screen-to-CAT Pediatric and Parent Proxy Anxiety computer adaptive tests are based on the exact same item banks, but utilize different stopping rules. The PROMIS Pediatric Bank v1.0 – Cognitive Function and PROMIS Parent Proxy Bank v1.1 – Cognitive Function measures are administered by default as computer adaptive tests using the following standard stopping rules:

- Minimum number of items administered = 4
- Stop when one of these occurs:
 - 12 items are administered OR
 - Standard error is below 0.3 on the theta metric (3.0 on the T-score metric)

The PROMIS Pediatric Bank v1.0 – Cognitive Function (recommended) and PROMIS Parent Proxy Bank v1.1 – Cognitive Function (recommended) measures use the following stopping rules:

- Minimum number of items administered = 4
- Stop when one of these occurs:
 - 12 items are administered OR
 - Standard error is below 0.3 on the theta metric (3.0 on the T-score metric) OR
 - Standard error changes by less than 0.01 on the theta metric (0.1 on the T-score metric)

The PROMIS Pediatric Bank v1.0 – Cognitive Function (screen-to-CAT) and PROMIS Parent Proxy Bank v1.1 – Cognitive Function (screen-to-CAT) measures use the following stopping rules:

- If the responses to the first two items are both the “healthiest” responses then stop.
- If the responses to the first two items are NOT the “healthiest” responses, proceed with the “recommended” CAT stopping rules.

Lai, J-S, Butt, Z., Zelko, F., Cella, D., Krull, K., Kieran, M., Goldman, S. (2011). Development of a Parent-reported Cognitive Function Item Bank Using Item Response Theory and Exploration of Its Clinical Utility in Computerized Adaptive Testing. Journal of Pediatric Psychology. 36(7):766-79.

Lai, J-S., Zelko, F., Krull, K., Cella, D., Nowinski, C., Manley, P., Goldman, S. (2014). Parent-reported cognition of children with cancer and its potential clinical usefulness. Quality of Life Research, 23, 1049-1058.

SHORT FORM DIFFERENCES

Adult Short Forms

There are 3 Cognitive Function and 3 Cognitive Function Abilities Subset adult short forms. Items were selected based on content and psychometric characteristics. Short form items are nested or overlap (e.g., an 8 item short form is the 4-item short form plus two additional items).

Pediatric and Parent Proxy Short Forms

There is 1 pediatric and 1 parent proxy short form. Items were selected based on content and psychometric characteristics.

Selecting a Short Form for Adults

In selecting between short forms, the difference is instrument length. The reliability and precision of the short forms within a domain is highly similar. If you are working with a sample in which you want the most precise measure, select the longest short form. If you have little room for additional measures but really wanted to capture something as a secondary outcome, select one of the shorter instruments (e.g., 4-item short form).

SELECTING A PEDIATRIC OR PARENT PROXY INSTRUMENT

In selecting whether to use the pediatric or parent proxy instrument for this domain, it is important to consider both the population and the domain which you are studying. Pediatric self-report should be considered the standard for measuring patient-reported outcomes among children. However, circumstances exist when the child is too young, cognitively impaired, or too ill to complete a patient-reported outcome instrument. While information derived from self-report and proxy-report is not equivalent, it is optimal to assess both the child and the parent since their perspectives may be independently related to healthcare utilization, risk factors, and quality of care.

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.

STATISTICAL CHARACTERISTICS

There are four key features of the score for cognitive function:

- **Reliability:** The degree to which a measure is free of error. It can be estimated by the internal consistency of the responses to the measure, or by correlating total scores on the measure from two time points when there has been no true change in what is being measured (for z-scores, reliability = $1 - SE^2$).
- **Precision:** The consistency of the estimated score (reciprocal of error variance).
- **Information:** The precision of an item or multiple items at different levels of the underlying continuum (for z-scores, information = $1/SE^2$).
- **Standard Error (SE):** The possible range of the actual final score based upon the scaled T-score. For example, with a T-score of 52 and a SE of 2, the 95% confidence interval around the actual final score ranges from 48.1 to 55.9 ($T\text{-score} \pm (1.96 * SE) = 52 \pm 3.9 = 48.1 \text{ to } 55.9$).

The final score is represented by the T-score, a standardized score with a mean of 50 and a standard deviation (SD) of 10. More information is available at [www. HealthMeasures.net](http://www.HealthMeasures.net).

PREVIEW OF SAMPLE ITEM

Figure 1 is an excerpt from the paper version of the adult v2.0 Cognitive Function eight-item short form. This is the paper version format used for all cognitive function instruments. It is important to note that the CAT is not available for paper administration.

In the past 7 days...		Never	Rarely (Once)	Sometimes (Two or three times)	Often (About once a day)	Very often (Several times a day)
PC1r	I have had trouble forming thoughts	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PC2r	My thinking has been slow.....	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Figure 1

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: Are these instruments available in other languages?

Yes! Look at the HealthMeasures website (<http://www.healthmeasures.net/explore-measurement-systems/promis/intro-to-promis/available-translations/117-available-translations>) for current information on PROMIS translations.

Q: Can I make my own short form?

Yes, custom short forms can be made by selecting any items from an item bank. This can be scored using the Scoring Service (https://www.assessmentcenter.net/ac_scoringervice).