

# Parent Report of Children's Abilities-Revised (PARCA-R)

Resources for obtaining PARCA-R standard scores for large data sets using data from the reference equations:  
User Guide

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## Obtaining PARCA-R standard scores for large data sets

### Please note:

This resource can be used to derive PARCA-R standard scores for large data sets for clinical use or for observational studies and clinical trials. If you are using this resource for Clinical Trials of Investigational Medicinal Products (CTIMPs), you may need to ensure it complies with the relevant regulatory guidance. We are unable to provide further support for this.

The PARCA-R is freely available for use non-commercially for clinical and research purposes. The PARCA-R questionnaire and associated resources must not be adapted in any way and must not be used for profit. If you have any queries about the use of the PARCA-R, please email the team at [parca-r@le.ac.uk](mailto:parca-r@le.ac.uk).

### Obtaining PARCA-R standard scores using the reference equations:

To obtain PARCA-R standard scores for large datasets using the reference equations, download R from <https://cran.r-project.org/bin/windows/base/> and install package “gamlss” (<https://cran.r-project.org/web/packages/gamlss/index.html>). Before you will be able to perform any calculations you will need to load the “gamlss” package on R, using the `library()` function (i.e. `library(gamlss)`).

To derive PARCA-R standard scores, you will need variables for the child’s sex, age at assessment in months and days (i.e. the child’s age when the PARCA-R was completed), and PARCA-R raw scores.

Within your data set, generate raw scores for the PARCA-R Non-Verbal Cognitive Scale and the Language Scale using the instructions provided in the Technical and Interpretive Manual (freely available to download at [www.parca-r.info](http://www.parca-r.info)). Ensure you follow the guidance on dealing with missing data provided on pages 32-33 of the test manual when generating raw scores.

Next, split your data into groups by:

- Sex:
  - Male
  - Female, and
  
- Age at PARCA-R assessment:
  - 24 months: 23 months 16 days to 24 months 15 days;
  - 25 months: 24 months 16 days to 25 months 15 days;
  - 26 months: 25 months 16 days to 26 months 15 days;
  - 27 months: 26 months 16 days to 27 months 15 days.

To obtain the standard scores follow the next steps:

1. Divide the raw scores for the Non-Verbal Cognitive Scale and the Language Scale by the total number of questions (i.e. 34 for the Non-Verbal Cognitive Scale; 124 for the Language Scale). This will give the proportion (q) of questions answered positively that is required for the next step. Round up/down these results to 3 decimal places.

For example, a raw score of 13 on the Non-Verbal Cognitive Scale is equivalent to 0.382, whilst a raw score of 13 on the Language Scale is equivalent to 0.105.

2. Use function:

**pBEINF(q, mu, sigma, nu, tau, lower.tail = TRUE, log.p = FALSE)**

to obtain the expected values for the raw value of the proportion (q), obtained from Step #1, using the data in **Table 1** to replace the four distribution parameters mu, sigma, nu and tau:

**Table 1:** Parameter estimates for the beta inflated distribution, separately for boys and girls, by age group.

	<b>23 months 16 days to 24 months 15 days</b>	<b>24 months 16 days to 25 months 15 days</b>	<b>25 months 16 days to 26 months 15 days</b>	<b>26 months 16 days to 27 months 15 days</b>
<b>BOYS</b>				
<i>Non-Verbal Cognitive Scale</i>				
mu	0.7896	0.8025	0.8135	0.8181
sigma	0.2587	0.2587	0.2587	0.2587
nu	0.00031	0.00031	0.00031	0.00031
tau	0.0175	0.0175	0.0175	0.0175
<i>Language Scale</i>				
mu	0.4762	0.4988	0.5249	0.5387
sigma	0.5057	0.5057	0.5057	0.5057
nu	0.0009	0.0009	0.0009	0.0009
tau	0.0039	0.0039	0.0039	0.0039
<b>GIRLS</b>				
<i>Non-Verbal Cognitive Scale</i>				
mu	0.8216	0.8291	0.8398	0.8507
sigma	0.2473	0.2473	0.2473	0.2473
nu	1.00E-09	1.00E-09	1.00E-09	1.00E-09
tau	0.0416	0.0416	0.0416	0.0416
<i>Language Scale</i>				
mu	0.5875	0.6170	0.6472	0.6687
sigma	0.4921	0.4921	0.4921	0.4921
nu	0.00033	0.00033	0.00033	0.00033
tau	0.007	0.0116	0.0192	0.0329

3. Convert the expected values for the two scales, obtained from Step #2, to z-scores (i.e. standardised scores with mean (SD) equal to 0 (1)), using function:

**qnorm(valuestep2, 0, 1).**

4. Rescale the z-scores, obtained from Step #3, to standard scores with mean (SD) equal to 100 (15) using the formula:

**Standard score= 100 + z-score\*15.**

5. Finally, round up or down to the nearest integer.

### Examples

**1)** A boy 25 months 10 days old with a raw score of 15 on the Non-Verbal Cognitive Scale has a standard score of 58:

Calculation steps:

1. Divide 15 by 34 → 0.441

2. Obtain the expected value using data for the Non-Verbal Cognitive Scale from **Table 1** above using data for a boy aged from 24 months 16 days to 25 months 15 days:

$\text{pBEINF}(0.441, 0.8025, 0.2587, 0.00031, 0.0175, \text{lower.tail} = \text{TRUE}, \text{log.p} = \text{FALSE}) \rightarrow 0.0025$

3. Convert the expected value to a z-score:  $\text{qnorm}(0.0025, 0, 1) \rightarrow -2.8085$

4. Rescale the z-score to a standard score:  $100 + (-2.8085) * 15 \rightarrow 57.87$

5. Round up to 58

**2)** A girl 26 months 3 days old with a raw score on the Language Scale of 73 has a standard score of 95:

Calculation steps:

1. Divide 73 by 124 → 0.589

2. Obtain the expected value for the Language Scale using data from **Table 1** above for a girl aged from 25 months 16 days to 26 months 15 days:

$\text{pBEINF}(0.589, 0.6472, 0.4921, 0.00033, 0.0192, \text{lower.tail} = \text{TRUE}, \text{log.p} = \text{FALSE}) \rightarrow 0.37$

3. Convert the expected value to a z-score:  $\text{qnorm}(0.37, 0, 1) \rightarrow -0.3319$

4. Rescale the z-score to a standard score:  $100 + (-0.3319) * 15 \rightarrow 95.02$

5. Round down to 95

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