**Appendix 1.** Illustrated below are look up tables converting raw Spanish NIH Toolbox Cognition Battery scores into normalized scaled scores (M=10, SD=3). The normalized scaled scores are for application in the age- and fully demographically-corrected formulas presented in Appendix 2. To use, select the scaled score table appropriate for the correction desired (age- or fully-corrected) and demographics (i.e., adult or child) of the given individual. The scaled score is then entered into the appropriate Appendix 2 formula in order to derive the desired corrected score.

**Raw to Scaled Score for use in Age- and Fully-corrected Formulas**

**Spanish Adults (18-85 years old)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ss |  |  |  |  |  |  |  | ss |
|  | **DCCS** | **Flanker** | **List Sort** | **Picture Sequence Memory** | **Pattern Comparison** | **Oral Reading** | **Picture Vocabulary** |  |
| 1 | 0.0-2.0054 | 0.0-2.2167 | 0-2 | 200.0-240.57 | 0-19 | -15.0- -12.27 | -15.0- -3.29 | **1** |
| 2 | 2.0055-2.0450 | 2.2168-3.5511 | 3-5 | 240.58-302.92 | 20-24 | -12.26- -8.55 | -3.28- -2.53 | **2** |
| 3 | 2.0451-2.0846 | 3.5512-3.8782 | 6 | 302.93-314.85 | 25-27 | -8.54- -4.25 | -2.52- -1.91 | **3** |
| 4 | 2.0847-2.1242 | 3.8783-4.2561 | 7 | 314.86-328.02 | 28-32 | -4.24- -2.24 | -1.90- -0.78 | **4** |
| 5 | 2.1243-2.2337 | 4.2562-4.8558 | 8 | 328.03-347.98 | 33-34 | -2.23- -0.99 | -0.77- -0.08 | **5** |
| 6 | 2.2338-2.9854 | 4.8559-5.8047 | 9-10 | 347.99-382.29 | 35-38 | -0.98-0.19 | -0.07-0.62 | **6** |
| 7 | 2.9855-5.1967 | 5.8048-6.6628 | 11 | 382.30-415.60 | 39-42 | 0.20-1.17 | 0.63-1.44 | **7** |
| 8 | 5.1968-6.6663 | 6.6629-7.2813 | 12-13 | 415.61-447.02 | 43-46 | 1.18-2.20 | 1.45-2.15 | **8** |
| 9 | 6.6664-7.1996 | 7.2814-7.8747 | 14 | 447.03-486.02 | 47-49 | 2.21-2.84 | 2.16-3.02 | **9** |
| 10 | 7.1997-7.7081 | 7.8748-8.2511 | --- | 486.03-524.13 | 50-53 | 2.85-3.45 | 3.03-3.72 | **10** |
| 11 | 7.7082-8.0149 | 8.2512-8.6100 | 15-16 | 524.14-553.85 | 54-56 | 3.46-3.92 | 3.73-4.28 | **11** |
| 12 | 8.0150-8.3414 | 8.6101-8.8794 | 17 | 553.86-581.33 | 57-60 | 3.93-4.52 | 4.29-5.01 | **12** |
| 13 | 8.3415-8.6681 | 8.8795-9.2239 | 18 | 581.34-614.50 | 61-63 | 4.53-5.21 | 5.02-5.59 | **13** |
| 14 | 8.6682-8.9667 | 9.2240-9.4928 | 19 | 614.51-647.19 | 64-66 | 5.22-5.84 | 5.60-5.91 | **14** |
| 15 | 8.9668-9.2697 | 9.4929-9.6015 | 20-21 | 647.20-679.22 | 67-70 | 5.85-6.68 | 5.92-6.32 | **15** |
| 16 | 9.2698-9.5231 | 9.6016-9.7463 | 22 | 679.23-700.22 | 71-72 | 6.69-7.60 | 6.33-6.95 | **16** |
| 17 | 9.5232-9.7529 | 9.7464-9.9189 | 23-24 | 700.23-727.13 | 73-75 | 7.61-10.26 | 6.96-7.80 | **17** |
| 18 | 9.7530-9.8465 | 9.9190-10.0 | 25 | 727.14-777.13 | 76-80 | 10.27-12.97 | 7.81-10.38 | **18** |
| 19 | 9.8466-10.0 | --- | 26 | 777.14-800.0 | 81-130 | 12.98-15.0 | 10.39-15.0 | **19** |
|  |  |  |  |  |  |  |  |  |

**Raw to Scaled Score for use in Age- and Fully-corrected Formulas**

**Spanish Children (3-7 years old)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ss |  |  |  |  |  |  |  | ss |
|  | **DCCS** | **Flanker** | **List Sort** | **Picture Sequence Memory** | **Pattern Comparison** | **Oral Reading** | **Picture Vocabulary** |  |
| 1 | 0.0-0.0450 | 0.0-0.1431 | --- | 200.0-203.78 | 0-9 | -15.0- -14.38 | -15.0- -8.09 | **1** |
| 2 | 0.0451-0.1006 | 0.1432-0.3668 | --- | 203.79-209.85 | 10-17 | -14.37- -12.25 | -8.08- -7.32 | **2** |
| 3 | 0.1007-0.1699 | 0.3669-0.5851 | --- | 209.86-222.41 | 18-19 | -12.24- -10.74 | -7.31- -6.74 | **3** |
| 4 | 0.1700-0.2501 | 0.5852-0.7633 | 0 | 222.42-234.92 | 20 | -10.73- -10.06 | -6.73- -6.00 | **4** |
| 5 | 0.2502-0.3711 | 0.7634-1.0106 | 1 | 234.93-265.17 | 21-22 | -10.05- -9.42 | -5.99- -5.57 | **5** |
| 6 | 0.3712-0.5848 | 1.0107-1.2479 | 2-3 | 265.18-278.30 | 23 | -9.41- -9.38 | -5.56- -5.05 | **6** |
| 7 | 0.5849-0.7446 | 1.2480-1.4969 | 4 | 278.31-299.61 | 24-27 | -9.37- -8.63 | -5.04- -4.31 | **7** |
| 8 | 0.7447-0.9366 | 1.4970-1.8443 | 5 | 299.62-331.60 | 28-30 | -8.62- -8.05 | -4.30- -3.69 | **8** |
| 9 | 0.9367-2.1315 | 1.8444-2.1975 | 6 | 331.61-349.97 | 31-35 | -8.04- -6.67 | -3.68- -2.89 | **9** |
| 10 | 2.1316-3.4622 | 2.1976-4.9949 | 7-8 | 349.98-385.62 | 36-38 | -6.66- -5.25 | -2.88- -2.19 | **10** |
| 11 | 3.4623-4.9085 | 4.9950-5.8689 | 9 | 385.63-416.84 | 39-41 | -5.24- -4.46 | -2.18- -1.69 | **11** |
| 12 | 4.9086-6.1072 | 5.8690-6.6244 | 10 | 416.85-454.97 | 42-44 | -4.45- -3.48 | -1.68- -1.22 | **12** |
| 13 | 6.1073-6.4982 | 6.6245-7.1510 | 11-12 | 454.98-470.93 | 45-47 | -3.47- -2.40 | -1.21- -0.71 | **13** |
| 14 | 6.4983-6.8405 | 7.1511-7.5392 | 13 | 470.94-480.85 | 48-51 | -2.39- -1.12 | -0.70- -0.09 | **14** |
| 15 | 6.8406-7.2028 | 7.5393-7.8889 | 14 | 480.86-489.49 | 52-53 | -1.11- -0.37 | -0.08-0.42 | **15** |
| 16 | 7.2029-7.6234 | 7.8890-8.3210 | 15-16 | 489.50-518.13 | 54-55 | -0.36-0.53 | 0.43-1.04 | **16** |
| 17 | 7.6235-8.7665 | 8.3211-8.5352 | 17 | 518.14-538.41 | 56-59 | 0.54-1.81 | 1.05-1.24 | **17** |
| 18 | 8.7666-9.5623 | 8.5353-9.3765 | 18-23 | 538.42-567.40 | 60-72 | 1.82-10.17 | 1.25-2.32 | **18** |
| 19 | 9.5624-10.0 | 9.3766-10.0 | 24-26 | 567.41-800.0 | 73-130 | 10.18-15.0 | 2.33-15.0 | **19** |
|  |  |  |  |  |  |  |  |  |

**Appendix 2.1 Formula Converting Raw scores to Uncorrected Normally-distributed Standard Scores.**

|  |  |
| --- | --- |
| **Test** | **Formula** |
| DCCS | [(DCCS raw score − 4.89) / 2.93] \* 15 + 100 |
| Flanker | [(Flanker raw score − 5.81) / 2.77] \* 15 + 100 |
| List Sort | [(List Sort raw score − 11.37) / 5.09] \* 15 + 100 |
| Picture Sequence Memory | [(Picture Sequence Memory raw score − 432.24) / 107.60] \* 15 + 100 |
| Pattern Comparison | [(Pattern Comparison raw score − 43.55) / 12.56] \* 15 + 100 |
| Oral Reading | [(Oral Reading raw score − (-2.97)) / 6.27] \* 15 + 100 |
| Picture Vocabulary | [(Picture Vocabulary raw score − (-0.06)) / 3.52] \* 15 + 100 |
| Fluid Composite | [(Mean of DCC, Flanker, List Sort, Pic Seq Mem, & Pattern Comparison Uncorrected Standard Scores – 100.47) / 13.34] \* 15 + 100 |
| Crystallized Composite | [(Mean of Oral Reading & Picture Vocabulary Uncorrected Standard Scores – 100.50) / 14.48] \* 15 + 100 |
| Total Composite | [(Mean of Uncorrected Fluid & Crystallized Composite Standard Scores – 103.86) / 12.81] \* 15 + 100 |

**Appendix 2.2 Formulas Converting Scaled Scores to Age-Corrected Standard Scores**

|  |  |
| --- | --- |
| **Test** | **Formula** |
| ***Spanish Adults*** | |
| DCCS | 100 + 15 \* {[(DCCS scaled score) − (13.48 – 7.84\*(age/100))] / [2.52 – 1.11\*(age/100)]} / 1.30 |
| Flanker | 100 + 15 \* {[(Flanker scaled score) − (13.91 – 8.89\*(age/100))] / [1.87 + 0.52\*(age/100)]} / 1.25 |
| List Sort | 100 + 15 \* {[(List Sort scaled score) − (13.37 − 7.97\*(age/100))] / [2.78 – 1.31\*(age/100)]} / 1.26 |
| Picture Sequence Memory | 100 + 15 \* {[(Picture Sequence Memory scaled score) − (13.40 – 8.57\*(age/100))] / [2.66 – 1.27\*(age/100)]} / 1.27 |
| Pattern Comparison | 100 + 15 \* {[(Pattern comp scaled score) − (13.97 – 9.07\*(age/100))] / [2.44 – 0.78\*(age/100)]} / 1.26 |
| Oral Reading | 100 + 15 \* {[(Reading scaled score) − (11.95 – 4.43\*(age/100))] / [1.96 + 0.81\*(age/100)]} / 1.26 |
| Picture Vocabulary | 100 + 15 \* {[(Vocabulary scaled score) − (3.90 + 32.00\*(age/100) – 36.02\*(age/100)^2)] / [1.45 + 1.78\*(age/100)]} / 1.25 |
| Fluid Composite | 100 + 15 \* {[(Mean of DCC, Flanker, List Sort, Pic Seq Mem, & Pattern Comparison Scaled Scores) – (13.36 – 7.41\*(age/100))] / [1.64 – 0.31\*(age/100)]} / 1.26 |
| Crystallized Composite | 100 + 15 \* {[(Mean of Oral Reading & Picture Vocabulary Scaled Scores) – (3.02 + 16.27\*(age/100)^0.5 – 16.23\*(age/100)^2)] / [1.70 + 0.74\*(age/100)]} / 1.24 |
| Total Cognition Composite | 100 + 15 \* {[(Mean of Fluid & Crystallized Composite Scaled Scores) – (12.04 – 4.30\*(age/100))] / [1.11 + 0.84\*(age/100)]} / 1.28 |
| ***Spanish Children*** | |
| DCCS | 100 + 15 \* {[(DCCS scaled score) − (4.04 + 11.68\*(age/10))] / [1.86 + 0.32\*(age/10)]} / 1.25 |
| Flanker | 100 + 15 \* {[(Flanker scaled score) − (2.76 + 14.10\*(age/10))] / [1.83 – 0.12\*(age/10)]} / 1.30 |
| List Sort | 100 + 15 \* {[(List Sort scaled score) − (3.04 + 12.79\*(age/10))] / [2.03 – 0.18\*(age/10)]} / 1.26 |
| Picture Sequence Memory | 100 + 15 \* {[(Picture Sequence Memory scaled score) − (14.93 + 6.86\*log(age/10))] / [1.49 + 0.63\*(age/10)]} / 1.23 |
| Pattern Comparison | 100 + 15 \* {[(Pattern Comp scaled score) − (3.36 + 12.88\*(age/10))] / [2.87 – 2.07\*(age/10)]} / 1.32 |
| Oral Reading | 100 + 15 \* {[(Reading scaled score) − (3.69 + 10.95\*(age/10))] / [1.51 + 1.13\*(age/10)]} / 1.23 |
| Picture Vocabulary | 100 + 15 \* {[(Vocabulary scaled score) − (3.84 + 12.48\*(age/10))] / [2.16 – 0.59\*(age/10)]} / 1.30 |
| Fluid Composite | 100 + 15 \* {[(Mean of DCC, Flanker, List Sort, Pic Seq Mem, & Pattern Comparison Scaled Scores) – (3.53 + 12.82\*(age/10))] / [1.11 + 0.11\*(age/10)]} / 1.23 |
| Crystallized Composite | 100 + 15 \* {[(Mean of Oral Reading & Picture Vocabulary Scaled Scores) – (4.35 + 10.99\*(age/10))] / [2.12 − 0.75\*(age/10)]} / 1.26 |
| Total Cognition Composite | 100 + 15 \* {[(Mean of Fluid & Crystallized Composite Scaled Scores) – (5.27 + 9.91\*(age/10))] / [1.51 − 0.55\*(age/10)]} / 1.22 |

**Appendix 2.3 Formulas Converting Scaled Scores to Fully-Corrected T-Scores.**

|  |  |
| --- | --- |
| **Test** | **Formula** |
| ***Spanish Adults*** | |
| DCCS | 50 + 10 \* {[(DCCS scaled score) − (11.00 – 7.24\*(age/100) + 1.27\*((edu+1)/10)^2 + 0.61\*male)] / [1.56 – 0.18\*(age/100) + 0.16\*((edu+1)/10) + 0.34\*male]} / 1.30 |
| Flanker | 50 + 10 \* {[(Flanker scaled score) − (10.16 − 7.95\*(age/100) + 2.64 \*((edu+1)/10) + 0.70\*male)] / [1.25 + 0.63\*(age/100) + 0.14\*((edu+1)/10) + 0.46\*male]} / 1.26 |
| List Sort | 50 + 10 \* {[(List Sort scaled score) − (10.68 − 7.14\*(age/100) + 1.95\*((edu+1)/10) + 0.05\*male)] / [2.55 – 1.20\*(age/100) + 0.08\*((edu+1)/10) – 0.03\*male]} / 1.26 |
| Picture Sequence Memory | 50 + 10 \* {[(Picture Sequence Memory scaled score) − (9.95 – 7.34\*(age/100) + 2.51\*((edu+1)/10) – 0.45\*male)] / [2.68 – 0.89\*(age/100) – 0.29\*((edu+1)/10) + 0.16\*male]} / 1.28 |
| Pattern Comparison | 50 + 10 \* {[(Pattern Comp scaled score) − (11.98 – 8.68\*(age/100) + 1.41\*((edu+1)/10) + 0.46\*male)] / [1.34 – 0.35\*(age/100) + 0.67\*((edu+1)/10) + 0.15\*male]} / 1.25 |
| Oral Reading | 50 + 10 \* {[(Reading scaled score) − (9.37 – 3.65\*(age/100) + 1.86\*((edu+1)/10) + 0.09\*male)] / [3.21 + 0.46\*(age/100) + 0.04\*((edu+1)/10)^−2 – 1.49\*((edu+1)/10)^−0.5 + 0.54\*male]} / 1.23 |
| Picture Vocabulary | 50 + 10 \* {[(Vocabulary scaled score) − (1.71 + 28.94\*(age/100) – 31.60\*(age/100)^2 + 2.23\*((edu+1)/10) – 0.20\*male)] / [0.64 + 1.74\*(age/100) + 0.49\*((edu+1)/10) + 0.39\*male]} / 1.25 |
| Fluid Composite | 50 + 10 \* {[(Mean of DCC, Flanker, List Sort, Pic Seq Mem, & Pattern Comparison Scaled Scores) – (9.79 – 6.58\*(age/100) + 2.55\*((edu+1)/10) + 0.33\*male)] / [1.57 – 0.33\*(age/100) – 0.14\*((edu+1)/10) + 0.12\*male]} / 1.25 |
| Crystallized Composite | 50 + 10 \* {[(Mean of Oral Reading & Picture Vocabulary Scaled Scores) – (5.09 + 15.77\*(age/100) – 19.13\*(age/100)^2 + 1.90\*((edu+1)/10) – 0.03\*male)] / [2.66 + 0.73\*(age/100) + 0.04\*((edu+1)/10)^–2 – 1.32\*((edu+1)/10)^–0.5 + 0.44\*male]} / 1.23 |
| Total Cognition Composite | 50 + 10 \* {[(Mean of Fluid & Crystallized Composite Scaled Scores) – (8.46 – 3.30\*(age/100) + 2.55\*((edu+1)/10) + 0.08\*male)] / [1.09 + 0.49\*(age/100) – 0.10\*((edu+1)/10) + 0.20\*male]} / 1.26 |
| ***Spanish Children*** | |
| DCCS | 50 + 10 \* {[(DCCS scaled score) − (2.91 + 11.80\*(age/10) + 1.13\*((edu+1)/10) – 0.28\*male)] / [1.68 + 0.31\*(age/10) + 0.11\*((edu+1)/10) + 0.03\*male]} / 1.26 |
| Flanker | 50 + 10 \* {[(Flanker scaled score) − (1.97 + 14.23\*(age/10) + 0.61\*((edu+1)/10) + 0.14\*male)] / [1.73 – 0.06\*(age/10) + 0.03\*((edu+1)/10) + 0.08\*male]} / 1.29 |
| List Sort | 50 + 10 \* {[(List Sort scaled score) − (2.10 + 13.09\*(age/10) + 0.97\*((edu+1)/10) – 0.55\*male)] / [1.72 − 0.07\*(age/10) + 0.06\*((edu+1)/10) + 0.34\*male]} / 1.26 |
| Picture Sequence Memory | 50 + 10 \* {[(Picture Sequence Memory scaled score) − (2.07 + 14.20\*(age/10) + 0.50\*((edu+1)/10) + 0.33\*male)] / [1.14 + 0.78\*(age/10) + 0.30\*((edu+1)/10) – 0.17\*male]} / 1.25 |
| Pattern Comparison | 50 + 10 \* {[(Pattern Comp scaled score) − (2.90 + 12.94\*(age/10) + 0.32\*((edu+1)/10) + 0.21\*male)] / [3.45 – 2.20\*(age/10) – 0.58\*((edu+1)/10) + 0.21\*male]} / 1.33 |
| Oral Reading | 50 + 10 \* {[(Reading scaled score) − (3.33 + 11.10\*(age/10) + 0.35\*((edu+1)/10) – 0.24\*male)] / [1.48 + 1.02\*(age/10) + 0.13\*((edu+1)/10) – 0.11\*male]} / 1.22 |
| Picture Vocabulary | 50 + 10 \* {[(Vocabulary scaled score) − (3.74 + 12.51\*(age/10) + 0.43\*((edu+1)/10) – 0.78\*male)] / [1.96 – 0.41\*(age/10) + 0.09\*((edu+1)/10) – 0.04\*male]} / 1.31 |
| Fluid Composite | 50 + 10 \* {[(Mean of DCC, Flanker, List Sort, Pic Seq Mem, & Pattern Comparison Scaled Scores) – (2.51 + 13.03\*(age/10) + 0.89\*((edu+1)/10) – 0.12\*male)] / [1.11 + 0.24\*(age/10) – 0.07\*((edu+1)/10) – 0.04\*male]} / 1.22 |
| Crystallized Composite | 50 + 10 \* {[(Mean of Oral Reading & Picture Vocabulary Scaled Scores) – (3.81 + 11.22\*(age/10) + 0.56\*((edu+1)/10) – 0.48\*male)] / [1.72 – 0.55\*(age/10) + 0.24\*((edu+1)/10) + 0.06\*male]} / 1.24 |
| Total Cognition Composite | 50 + 10 \* {[(Mean of Fluid & Crystallized Composite Scaled Scores) – (4.66 + 10.23\*(age/10) + 0.50\*((edu+1)/10) – 0.28\*male)] / [1.58 – 0.64\*(age/10) – 0.03\*((edu+1)/10) + 0.03\*male]} / 1.22 |