

**Supplement 1**

**Cognitive task descriptions and scores**

**Trails**

Task description

Geometric trails with two baseline conditions (one connecting circles in ascending order of size; another connecting squares in descending order of size) and a switching condition (connecting squares in descending order of size and circles in ascending order of size, with alternation from largest square to smallest circle etc.).

Scores

- Combined baseline accuracy: number of correct connections in the two baseline conditions divided by the total number of possible correct connections (maximum 14/14).
- Switch accuracy: number of correct connections in the switch condition divided by the total number of possible correct connections (maximum 14/14).
- Switch accuracy cost: switch accuracy divided by combined baseline accuracy, capped at a maximum of 1 (42).
- Switch duration cost: switch duration (capped at 120 seconds) divided by combined baseline duration (capped at 120 seconds).

**Iowa Gambling Task**

Task description

Iowa Gambling Task based on a simplified version of the task (Kerr & Zelazo, 2004) (50 trials; two decks of cards: a low-risk advantageous deck with low rewards but low penalties resulting in overall net gain in points, and a high-risk disadvantageous deck with high rewards but higher penalties with overall net loss of points) adapted for adolescents by happy and sad faces being replaced with points displayed on cards with each trial being awarded and penalised in multiples of 100 (rather than single digits).

Score

Net score: proportion of advantageous choices minus proportion of disadvantageous choices in the last 30 trials.

### **Emotional go/no-go**

#### Task description

Emotional go/no-go with fearful and happy conditions, based on the task interpretation described by Casey and colleagues (Hare et al., 2008). Neutral faces were always the target for go trials; emotional faces were always the distractor for no-go trials.

#### Score

D-prime: calculated by subtracting the z-transformed (using the inverse normal distribution) proportion of commission errors on no-go trials from the z-transformed proportion of correct hits on go trials. Ceiling scores (0% commission errors or 100% correct hits) were replaced as follows to allow z-transformation: correct hit rate of 1  $\rightarrow$   $1 - 1/2N$  (N being the total number of go trials i.e. 96); commission error rate of 0  $\rightarrow$   $0 + 1/2N$  (N being the total number of no-go trials i.e. 48).

### **Rule-finding**

#### Task description

This is a visuospatial rule-finding task with five visuospatial rules to be figured out (Demeyere et al., 2019; Humphreys et al., 2017). Participants are not warned when shifts to a new rule occur.

#### Score

Proportion accuracy: number of correct moves divided by the total number of possible correct moves with the first move in each new rule not scored (maximum 46/46).

### **Figure drawing**

#### Task description

This figure drawing task is similar to but simpler than the Rey-Osterrieth complex figure task (Watanabe et al., 2005). In the copy condition, the figure remains on screen for the participant to copy while they draw. In the immediate recall condition which occurs immediately after the copy condition, the figure reappears on screen briefly for a few seconds before disappearing. The participant then needs to draw the figure from memory.

## Scores

- Copy accuracy: number of correct components (each of the 20 drawing elements scored on presence, accuracy, and position) divided by total number of possible correct components (maximum 60/60).
- Recall accuracy: calculated as above.

## **Selection**

### Task description

This selection or cancellation task presented participants with a distribution of 60 items: 30 vegetables (10 items of each of three vegetable types) and 30 fruit (10 items of each of three fruit types). Participants had to select fruits (targets), ignoring the vegetables (distractors). In the visible condition, there was sustained visual feedback highlighting items already selected. In the invisible condition, the items were highlighted briefly then the feedback disappeared meaning participants had to remember which items they had selected previously.

### Scores

- Visible accuracy: the proportion accuracy i.e. the number of targets selected only once minus distractors selected, divided by the total number of targets (maximum 30/30).
- Invisible accuracy: the proportion accuracy i.e. the number of targets selected only once minus distractors selected, divided by the total number of targets (maximum 30/30).

## **Digit recall**

### Task description

The auditory digit recall consisted of two conditions, forwards and backwards, with a maximum of three attempts at each level starting from a string of two digits up to a maximum string of nine digits from 1 to 9). This task has been normed in a South African context (Singh et al., 2010; Skuy, Schutte, Fridjhon, & O'Carroll, 2001).

### Scores

- Maximum forwards and backwards spans: length (number of digits) of longest sequence remembered and recited correctly (maximum 9).

## 1 Supplement 2

2 Table A. Executive function task scores in HIV-positive cases compared to matched HIV-negative controls

| Characteristic               | Controls (HIV-negative) |                    |     | Cases (HIV-positive) |                    |    | Effect size (Hedge's g, 95% CI) | Univariate mean comparisons |                          | Multivariate analysis |
|------------------------------|-------------------------|--------------------|-----|----------------------|--------------------|----|---------------------------------|-----------------------------|--------------------------|-----------------------|
|                              | Unadj. mean (95% CI)    | Adj. mean (95% CI) | n   | Unadj. mean (95% CI) | Adj. mean (95% CI) | n  |                                 | n                           | Unadj. p value           | Adj. p                |
| Digits forwards              | 5.47 (5.23, 5.72)       | 5.47 (5.23, 5.70)  | 150 | 5.27 (4.95, 5.58)    | 5.28 (4.94, 5.61)  | 75 | -0.14 (-0.42, 0.14)             | 225                         | t = 1.00<br>p = 0.3203   | 0.352                 |
| Digits backwards             | 3.95 (3.67, 4.22)       | 3.94 (3.67, 4.21)  | 150 | 3.32 (2.96, 3.68)    | 3.33 (2.95, 3.71)  | 75 | -0.38 (-0.66, -0.10)            | 225                         | t = 2.69<br>p = 0.0076** | 0.010*                |
| Trails baseline accuracy     | 0.76 (0.72, 0.80)       | 0.75 (0.71, 0.80)  | 146 | 0.76 (0.70, 0.82)    | 0.77 (0.71, 0.83)  | 71 | 0.01 (-0.27, 0.29)              | 217                         | z = 0.02<br>p = 0.9859   | 0.689                 |
| Trails switch accuracy       | 0.51 (0.46, 0.55)       | 0.51 (0.46, 0.56)  | 146 | 0.55 (0.47, 0.63)    | 0.55 (0.48, 0.62)  | 71 | 0.15 (-0.14, 0.43)              | 217                         | z = -0.85<br>p = 0.3968  | 0.314                 |
| Trails switch accuracy cost  | 0.64 (0.59, 0.69)       | 0.64 (0.59, 0.69)  | 136 | 0.64 (0.56, 0.72)    | 0.63 (0.56, 0.71)  | 69 | 0.00 (-0.29, 0.29)              | 205                         | z = -0.12<br>p = 0.9046  | 0.903                 |
| Trails switch duration cost  | 1.19 (1.08, 1.29)       | 1.18 (1.07, 1.30)  | 146 | 1.15 (0.98, 1.32)    | 1.15 (0.99, 1.31)  | 71 | 0.05 (-0.23, 0.34)              | 217                         | t = 0.37<br>p = 0.7143   | 0.733                 |
| Rule-finding accuracy        | 0.49 (0.45, 0.52)       | 0.49 (0.45, 0.53)  | 153 | 0.46 (0.41, 0.51)    | 0.47 (0.42, 0.53)  | 77 | -0.11 (-0.39, 0.16)             | 230                         | t = 0.81<br>p = 0.4168   | 0.533                 |
| Iowa net score               | 0.27 (0.17, 0.37)       | 0.30 (0.19, 0.40)  | 152 | 0.23 (0.08, 0.37)    | 0.27 (0.13, 0.41)  | 76 | 0.06 (-0.21, 0.34)              | 228                         | z = 0.37<br>p = 0.7084   | 0.735                 |
| D prime                      | 2.06 (1.90, 2.21)       | 2.05 (1.89, 2.21)  | 153 | 2.02 (1.81, 2.24)    | 2.06 (1.84, 2.28)  | 77 | -0.03 (-0.31, 0.24)             | 230                         | t = 0.23<br>p = 0.8151   | 0.927                 |
| Selection visible accuracy   | 0.95 (0.93, 0.96)       | 0.95 (0.93, 0.97)  | 146 | 0.93 (0.90, 0.96)    | 0.93 (0.91, 0.96)  | 75 | -0.15 (-0.43, 0.13)             | 221                         | z = 1.216<br>p = 0.2239  | 0.333                 |
| Selection invisible accuracy | 0.80 (0.77, 0.83)       | 0.80 (0.77, 0.83)  | 146 | 0.82 (0.78, 0.86)    | 0.82 (0.78, 0.86)  | 75 | 0.15 (-0.13, 0.42)              | 221                         | z = -1.304<br>p = 0.1922 | 0.352                 |
| Figure copy accuracy         | 0.88 (0.85, 0.90)       | 0.87 (0.85, 0.90)  | 150 | 0.86 (0.83, 0.89)    | 0.86 (0.83, 0.89)  | 77 | -0.12 (-0.39, 0.16)             | 227                         | z = 1.829<br>p = 0.0674  | 0.526                 |
| Figure recall accuracy       | 0.78 (0.76, 0.81)       | 0.78 (0.75, 0.81)  | 150 | 0.77 (0.73, 0.81)    | 0.78 (0.74, 0.81)  | 77 | -0.08 (-0.35, 0.20)             | 227                         | z = 0.822<br>p = 0.4114  | 0.832                 |

3 Key: Unadj. = unadjusted; adj. = adjusted; \* p &lt; 0.05; \*\* p &lt; 0.01; \*\*\* p &lt; 0.001. Adjusted models adjusted for age, socioeconomic status, and education level.

1    Table B. Executive function task scores by CD4 cell count classification in HIV-positive cases

|                    |                      | CD4 cell count ≥ 350<br>(n = 58) | CD4 cell count < 350 (n = 10) |
|--------------------|----------------------|----------------------------------|-------------------------------|
| Cognitive Task     | Outcome              | Unadjusted mean (95% CI)         | Unadjusted mean (95% CI)      |
| Digit recall       | Forwards span        | 5.32 (4.95, 5.68)                | 4.80 (3.74, 5.86)             |
|                    | Backwards span       | 3.49 (3.08, 3.90)                | 2.70 (1.67, 3.73)             |
| Trails             | Baseline accuracy    | 0.78 (0.71, 0.85)                | 0.69 (0.52, 0.85)             |
|                    | Switch accuracy      | 0.59 (0.51, 0.67)                | 0.45 (0.15, 0.75)             |
|                    | Switch accuracy cost | 0.69 (0.61, 0.77)                | 0.53 (0.21, 0.85)             |
|                    | Switch duration cost | 1.21 (0.99, 1.42)                | 0.97 (0.73, 1.21)             |
| Rule-finding       | Accuracy             | 0.45 (0.39, 0.50)                | 0.62 (0.43, 0.81)             |
| Iowa Gambling Task | Net score            | 0.22 (0.06, 0.39)                | 0.30 (-0.22, 0.82)            |
| Emotional go/no-go | D-prime              | 2.01 (1.75, 2.27)                | 2.00 (1.25, 2.74)             |
| Selection          | Visible accuracy     | 0.94 (0.92, 0.97)                | 0.87 (0.66, 1.07)             |
|                    | Invisible accuracy   | 0.84 (0.79, 0.88)                | 0.73 (0.56, 0.89)             |
| Figure drawing     | Copy accuracy        | 0.86 (0.83, 0.89)                | 0.81 (0.68, 0.94)             |
|                    | Recall accuracy      | 0.78 (0.73, 0.82)                | 0.76 (0.61, 0.91)             |

2    Key: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001.

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1 Table C. Executive function task scores by viral load classification in HIV-positive cases

| Cognitive Task     | Outcome              | Viral load < 1000 copies/ml (n = 26) |                        | Viral load ≥ 1000 copies/ml (n = 49) |                        | Effect size         | n  | Hypothesis testing      | n  | Regression analysis |
|--------------------|----------------------|--------------------------------------|------------------------|--------------------------------------|------------------------|---------------------|----|-------------------------|----|---------------------|
|                    |                      | Unadjusted mean (95% CI)             | Adjusted mean (95% CI) | Unadjusted mean (95% CI)             | Adjusted mean (95% CI) | Hedge's g (95% CI)  |    | Unadjusted p            |    | Adjusted p          |
| Digit recall       | Forwards span        | 5.13 (4.71, 5.54)                    | 5.09 (4.49, 5.70)      | 5.35 (4.90, 5.81)                    | 5.37 (4.95, 5.79)      | 0.16 (-0.32, 0.65)  | 72 | t = -0.65<br>p = 0.5154 | 64 | 0.470               |
|                    | Backwards span       | 3.25 (2.87, 3.63)                    | 3.20 (2.50, 3.89)      | 3.31 (2.78, 3.85)                    | 3.34 (2.86, 3.82)      | 0.04 (-0.45, 0.52)  | 72 | t = -0.16<br>p = 0.8755 | 64 | 0.744               |
| Trails             | Baseline accuracy    | 0.75 (0.64, 0.85)                    | 0.73 (0.63, 0.84)      | 0.77 (0.70, 0.85)                    | 0.78 (0.71, 0.85)      | 0.11 (-0.39, 0.61)  | 68 | z = -0.66<br>p = 0.5094 | 60 | 0.494               |
|                    | Switch accuracy      | 0.58 (0.44, 0.73)                    | 0.57 (0.43, 0.72)      | 0.55 (0.45, 0.65)                    | 0.55 (0.45, 0.65)      | -0.10 (-0.60, 0.39) | 66 | z = 0.55<br>p = 0.5845  | 60 | 0.791               |
|                    | Switch accuracy cost | 0.68 (0.54, 0.82)                    | 0.67 (0.52, 0.82)      | 0.62 (0.51, 0.72)                    | 0.62 (0.52, 0.73)      | 0.20 (-0.30, 0.70)  | 66 | z = 0.79<br>p = 0.4312  | 66 | 0.609               |
|                    | Switch duration cost | 1.25 (0.94, 1.56)                    | 1.19 (0.90, 1.49)      | 1.03 (0.85, 1.22)                    | 1.06 (0.86, 1.27)      | 0.33 (-0.17, 0.83)  | 68 | t = 1.32<br>p = 0.1924  | 68 | 0.484               |
| Rule-finding       | Accuracy             | 0.47 (0.38, 0.57)                    | 0.46 (0.37, 0.56)      | 0.46 (0.39, 0.53)                    | 0.46 (0.40, 0.53)      | -0.07 (-0.54, 0.41) | 74 | t = 0.27<br>p = 0.7846  | 65 | 0.992               |
| Iowa Gambling Task | Net score            | 0.33 (0.06, 0.60)                    | 0.28 (0.01, 0.55)      | 0.15 (-0.03, 0.33)                   | 0.17 (-0.02, 0.36)     | 0.28 (-0.20, 0.76)  | 73 | z = 1.47<br>p = 0.1419  | 73 | 0.522               |
| Emotional go/no-go | D-prime              | 2.16 (1.78, 2.54)                    | 2.15 (1.73, 2.57)      | 1.91 (1.63, 2.20)                    | 1.92 (1.63, 2.21)      | -0.25 (-0.73, 0.23) | 74 | t = 1.03<br>p = 0.3057  | 65 | 0.383               |
| Selection          | Visible accuracy     | 0.95 (0.91, 0.98)                    | 0.94 (0.89, 1.00)      | 0.92 (0.88, 0.97)                    | 0.92 (0.89, 0.96)      | -0.18 (-0.66, 0.31) | 73 | z = 0.59<br>p = 0.5554  | 64 | 0.596               |
|                    | Invisible accuracy   | 0.82 (0.76, 0.88)                    | 0.83 (0.75, 0.91)      | 0.84 (0.79, 0.89)                    | 0.82 (0.77, 0.88)      | 0.11 (-0.38, 0.59)  | 72 | z = -0.49<br>p = 0.6241 | 64 | 0.886               |
| Figure drawing     | Copy accuracy        | 0.84 (0.80, 0.89)                    | 0.84 (0.79, 0.89)      | 0.87 (0.83, 0.90)                    | 0.87 (0.83, 0.90)      | 0.20 (-0.28, 0.68)  | 74 | z = -1.38<br>p = 0.1674 | 65 | 0.357               |
|                    | Recall accuracy      | 0.77 (0.70, 0.84)                    | 0.76 (0.69, 0.82)      | 0.77 (0.72, 0.82)                    | 0.78 (0.73, 0.83)      | 0.01 (-0.47, 0.48)  | 68 | z = -0.16<br>p = 0.8727 | 65 | 0.614               |

2 Key: \* p &lt; 0.05; \*\* p &lt; 0.01; \*\*\* p &lt; 0.001. Adjusted models adjusted for age, socioeconomic status, and education level.