# Supplementary Material

**Supplemental Table 1.** Patient characteristics by diagnostic group.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | SCD | MCI | Ad dementia | FTD | VD | DLB | PPA | Other dementia |
| N | 1,369 | 756 | 856 | 203 | 83 | 149 | 58 | 125 |
| Age in years | 59.7 ± 9.1 | 66.3 ± 7.5 | 66.8 ± 7.9 | 63.1 ± 7.8 | 69.1 ± 6.8 | 68.6 ± 6.4 | 66.6 ± 7.2 | 65.8 ± 7.9 |
| Female, n (%) | 592 (40.6) | 275 (36.4) | 381 (44.5) | 80 (39.4) | 27 (32.5) | 24 (16.1) | 26 (44.8) | 57 (45.6) |
| Education years, M (IQR) | 13 (10–13) | 10 (9–13) | 10 (9–13) | 10 (9–13) | 10 (9–13) | 10 (9–13) | 11.5 (9.25–13) | 10 (9–13) |
| Aβ status, n abnormal/n available (%) | 219/957 (22.9) | 348/625 (55.7) | 648/712 (91.0) | 28/160 (17.5) | 22/53 (41.5) | 67/118 (56.8) | 22/47 (46.8) | 36/97 (37.1) |
| MTA, average left/right, M (IQR) | 0 (0–0.5) | 1 (0–1.5) | 1.5 (0.5–2) | 1.5 (1–2) | 1.5 (1–2) | 1 (0.5–1) | 1 (0.5–1.5) | 1.5 (1–1.5) |
| MMSE | 28.2 ± 1.7 | 26.6 ± 2.3 | 22.7 ± 3.9 | 24.7 ± 3.9 | 24.0 ± 3.7 | 23.9 ± 3.4 | 25.1 ± 3.3 | 24.3 ± 3.9 |
| GDS | 3.3 ± 2.8 | 3.3 ± 2.9 | 2.9 ± 2.6 | 3.4 ± 3.3 | 3.9 ± 3.0 | 4.3 ± 3.0 | 4.2 ± 3.3 | 4.4 ± 3.5 |
| VATA, 3 trialsB, 3 trials | 17.6 ± 1.016.7 ± 1.7 | 15.9 ± 2.813.3 ± 4.3 | 13.3 ± 4.09.5 ± 5.2 | 15.8 ± 3.113.3 ± 4.5 | 14.9 ± 3.313.1 ± 4.2 | 16.3 ± 2.814.5 ± 4.1 | 16.8 ± 2.015.7 ± 2.7 | 16.3 ± 2.814.5 ± 4.1 |
| AVLTImmediateDelayed | 41.6 ± 9.58.4 ± 2.9 | 30.2 ± 7.43.9 ± 2.6 | 23.5 ± 7.92.4 ± 2.5 | 29.3 ± 10.04.7 ± 3.4 | 25.3 ± 7.93.7 ± 2.7 | 25.3 ± 8.84.2 ± 2.7 | 28.3 ± 11.25.1 ± 3.5 | 28.1 ± 8.54.9 ± 2.9 |
| RCFT immediate recall | 19.5 ± 5.6 | 12.8 ± 5.6 | 8.9 ± 5.5 | 12.9 ± 7.4 | 12.4 ± 5.4 | 10.4 ± 4.6 | 15.4 ± 6.3 | 13.8 ± 4.9 |

All data displayed as mean ± standard deviation, except as noted otherwise.

*Abbreviations:* AD, Alzheimer’s disease; DLB, dementia with Lewy bodies; FTD, frontotemporal dementia; MCI, mild cognitive impairment; PPA, primary progressive aphasia; SCD, subjective cognitive decline; VD, vascular dementia.

**Supplemental Table 2.** Areas under the curves for distinguishing AD dementia from clinical stages and other types of dementia, with 95% confidence intervals, stratified by VAT version.

| AD dementia vs. | VAT-A/C | VAT-B/D | VAT-A/C + VAT-B/D |
| --- | --- | --- | --- |
| Clinical stage |  |  |  |
| *Both versions*SCDMCI | 0.88 [0.86, 0.89]0.72 [0.69, 0.74] | 0.91 [0.90, 0.93]0.71 [0.69, 0.74] | 0.93 [0.91, 0.94]0.74 [0.71, 0.76] |
| *VAT A+B*SCDMCI | 0.87 [0.86, 0.89]0.71 [0.68, 0.74] | 0.91 [0.90, 0.93]0.71 [0.69, 0.74] | 0.93 [0.91, 0.94]0.73 [0.71, 0.76] |
| *VAT C+D*SCDMCI | 0.88 [0.82, 0.93]0.74 [0.64, 0.83] | 0.93 [0.88, 0.97]0.75 [0.66, 0.84] | 0.93 [0.89, 0.96]0.76 [0.67, 0.85] |
| Dementia type |  |  |  |
| *Both versions*ftdVDDLBPPAAny type | 0.75 [0.71, 0.79]0.71 [0.65, 0.77]0.62 [0.57, 0.66]0.80 [0.75, 0.85]0.72 [0.69, 0.75] | 0.76 [0.72, 0.79]0.72 [0.66, 0.77]0.70 [0.66, 0.75]0.85 [0.81, 0.89]0.75 [0.73, 0.78] | 0.77 [0.73, 0.81]0.73 [0.68, 0.79]0.70 [0.66, 0.75]0.86 [0.82, 0.90]0.76 [0.73, 0.78] |
| *VAT A+B*ftdVDDLBPPAAny type | 0.75 [0.71, 0.79]0.71 [0.65, 0.77]0.63 [0.58, 0.68]0.81 [0.76, 0.87]0.72 [0.70, 0.75] | 0.76 [0.72, 0.80]0.71 [0.65, 0.77]0.72 [0.67, 0.76]0.85 [0.80, 0.89]0.75 [0.73, 0.78] | 0.77 [0.73, 0.81]0.73 [0.67, 0.79]0.72 [0.67, 0.76]0.86 [0.81, 0.90]0.76 [0.74, 0.79] |
| *VAT C+D*ftdVDDLBPPAAny type | 0.77 [0.64, 0.89]0.68 [0.37, 0.99]0.54 [0.38, 0.69]0.81 [0.65, 0.96]0.72 [0.64, 0.80] | 0.72 [0.59, 0.86]0.77 [0.52, 1.00]0.57 [0.43, 0.72]0.90 [0.82, 0.99]0.74 [0.66, 0.82] | 0.75 [0.62, 0.88]0.75 [0.47, 1.00]0.58 [0.43, 0.72]0.89 [0.80, 0.98]0.74 [0.66, 0.82] |

Parallel versions of AVLT (different word list) and RCFT (Modified Taylor Complex Figure) were also administered when the parallel version of the VAT was used.

*Abbreviations:* AD, Alzheimer’s disease; AVLT, Auditory Verbal Learning Task; DLB, dementia with Lewy bodies; FTD, frontotemporal dementia; MCI, mild cognitive impairment; PPA, primary progressive aphasia; RCFT, Rey Complex Figure Test; SCD, subjective cognitive decline; VAT, Visual Association Test; VD, vascular dementia.

**Supplemental Table 3.** Areas under the curves for distinguishing AD dementia from clinical stages and other types of dementia, with 95% confidence intervals, with and without carrying forward of scores.

| AD dementia vs. | VAT-A | VAT-B | VAT-A + VAT-B |
| --- | --- | --- | --- |
| Clinical stage |  |  |  |
| *With scores carried forward*SCDMCI | 0.88 [0.86, 0.89]0.72 [0.69, 0.74] | 0.91 [0.90, 0.93]0.71 [0.69, 0.74] | 0.93 [0.91, 0.94]0.74 [0.71, 0.76] |
| *Without scores carried forward1*SCDMCI | 0.87 [0.85, 0.89]0.71 [0.69, 0.74] | 0.90 [0.88, 0.92]0.70 [0.68, 0.73] | 0.92 [0.90, 0.93]0.72 [0.70, 0.75] |
| Dementia type |  |  |  |
| *With scores carried forward*ftdVDDLBPPAAny type | 0.75 [0.71, 0.79]0.71 [0.65, 0.77]0.62 [0.57, 0.66]0.80 [0.75, 0.85]0.72 [0.69, 0.75] | 0.76 [0.72, 0.79]0.72 [0.66, 0.77]0.70 [0.66, 0.75]0.85 [0.81, 0.89]0.75 [0.73, 0.78] | 0.77 [0.73, 0.81]0.73 [0.68, 0.79]0.70 [0.66, 0.75]0.86 [0.82, 0.90]0.76 [0.73, 0.78] |
| *Without scores carried forward1*ftdVDDLBPPAAny type | 0.75 [0.71, 0.79]0.73 [0.67, 0.78]0.62 [0.57, 0.66]0.80 [0.74, 0.85]0.72 [0.70, 0.75] | 0.76 [0.72, 0.80]0.73 [0.67, 0.79]0.70 [0.66, 0.75]0.83 [0.78, 0.88]0.75 [0.73, 0.78] | 0.78 [0.74, 0.82]0.74 [0.69, 0.80]0.71 [0.66, 0.75]0.84 [0.79, 0.89]0.76 [0.73, 0.79] |

1 Excluding the 324 participants who did not achieve a score of 6 on the second trial but were not administered a third set.

*Abbreviations:* AD, Alzheimer’s disease; AVLT, Auditory Verbal Learning Task; DLB, dementia with Lewy bodies; FTD, frontotemporal dementia; MCI, mild cognitive impairment; PPA, primary progressive aphasia; RCFT, Rey Complex Figure Test; SCD, subjective cognitive decline; VAT, Visual Association Test; VD, vascular dementia.

**Supplemental Table 4.** Predicting VAT performance based on average MTA score, stratified by VAT version.

| Model | Learned all on VAT A/C,but not on VAT B/D | Did not learn all associations on VAT A/C, nor VAT B/D |
| --- | --- | --- |
| OR [95%CI] | *p* | OR [95%CI] | *p* |
| 1: Unadjusted |  |  |  |  |
| *Both versions*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.80 [1.34, 2.43]2.80 [2.16, 3.64]4.47 [3.31, 6.06]4.25 [3.11, 5.81]7.60 [4.82, 11.99]7.35 [4.46, 12.13] | < .001< .001< .001< .001< .001< .001 | 2.52 [1.81, 3.53]3.38 [2.49, 4.58]6.39 [4.56, 8.95]6.14 [4.34, 8.68]6.86 [3.99, 11.80]13.37 [8.08, 22.13] | < .001< .001< .001< .001< .001< .001 |
| *VAT A+B*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.83 [1.35, 2.49]3.06 [2.34, 4.00]4.73 [3.46, 6.47]4.76 [3.45, 6.57]8.46 [5.26, 13.61]7.20 [4.28, 12.11] | < .001< .001< .001< .001< .001< .001 | 2.54 [1.77, 3.64]3.55 [2.56, 4.92]7.37 [5.17, 10.51]6.46 [4.45, 9.37]8.61 [4.92, 15.08]13.04 [7.64, 22.26] | < .001< .001< .001< .001< .001< .001 |
| *VAT C+D1*MTA 0.5MTA 1MTA 1.5MTA 2 or 2.5MTA ≥3 | 1.38 [0.43, 4.42]0.65 [0.20, 2.14]2.00 [0.61, 6.57]1.07 [0.32, 3.60]9.00 [1.29, 62.59] | .343.311.208.397.034 | 2.03 [0.76, 5.41]1.67 [0.69, 4.06]1.07 [0.30, 3.84]2.23 [0.86, 5.75]14.40 [2.53, 81.98] | .146.210.397.101.004 |
| 2: Adjusted for age, sex, and education |  |  |  |  |
| *Both versions*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.63 [1.20, 2.21]2.18 [1.66, 2.88]3.35 [2.43, 4.61]3.16 [2.27, 4.41]5.60 [3.47, 9.03]5.13 [3.04, 8.65] | .003< .001< .001< .001< .001< .001 | 2.37 [1.68, 3.33]2.92 [2.11, 4.03]5.31 [3.71, 7.60]5.29 [3.66, 7.65]6.23 [3.54, 10.97]11.31 [6.66, 19.21] | < .001< .001< .001< .001< .001< .001 |
| *VAT A+B*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.64 [1.20, 2.25]2.33 [1.76, 3.11]3.47 [2.49, 4.85]3.45 [2.45, 4.87]6.11 [3.71, 10.07]4.78 [2.77, 8.23] | .004< .001< .001< .001< .001< .001 | 2.32 [1.61, 3.34]2.90 [2.05, 4.09]5.77 [3.95, 8.42]5.19 [3.49, 7.71]7.36 [4.09, 13.22]9.97 [5.67, 17.53] | < .001< .001< .001< .001< .001< .001 |
| *VAT C+D1*MTA 0.5MTA 1MTA 1.5MTA 2 or 2.5MTA ≥3 | 1.54 [0.47, 5.03]0.74 [0.22, 2.53]2.05 [0.59, 7.12]1.23 [0.34, 4.51]10.70 [1.43, 80.06] | .310.356.209.380.028 | 2.74 [0.97, 7.77]2.46 [0.94, 6.46]1.44 [0.37, 5.52]3.49 [1.21, 10.04]21.65 [18.00, 26.04] | .066.074.347.027< .001 |

All models use MTA 0 and the group of patients learning all associations on both sets (A+B/C+D) as the reference. 1 The models for VAT-C+D did not support the MTA 2.5 due to limited observations; this category was folded into MTA 2.

*Abbreviations:* MTA, medial temporal lobe atrophy; OR, odds ratio; VAT, Visual Association Test; 95%CI, 95% confidence interval.

**Supplemental Table 5.** Predicting VAT performance based on average MTA score, with and without carrying forward of scores.

| Model | Learned all on VAT A,but not on VAT B | Did not learn all associations on VAT A, nor VAT B |
| --- | --- | --- |
| OR [95%CI] | *p* | OR [95%CI] | *p* |
| 1: Unadjusted |  |  |  |  |
| *With scores carried forward*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.80 [1.34, 2.43]2.80 [2.16, 3.64]4.47 [3.31, 6.06]4.25 [3.11, 5.81]7.60 [4.82, 11.99]7.35 [4.46, 12.13] | < .001< .001< .001< .001< .001< .001 | 2.52 [1.81, 3.53]3.38 [2.49, 4.58]6.39 [4.56, 8.95]6.14 [4.34, 8.68]6.86 [3.99, 11.80]13.37 [8.08, 22.13] | < .001< .001< .001< .001< .001< .001 |
| *Without scores carried forward1*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.89 [1.34, 2.65]3.11 [2.32, 4.17]4.92 [3.51, 6.90]4.02 [2.81, 5.76]7.08 [4.23, 11.85]6.22 [3.48, 11.13] | < .001< .001< .001< .001< .001< .001 | 2.29 [1.61, 3.26]3.38 [2.46, 4.63]6.04 [4.25, 8.57]5.49 [3.82, 7.90]6.73 [3.85, 11.78]13.56 [8.12, 22.65] | < .001< .001< .001< .001< .001< .001 |
| 2: Adjusted for age, sex, and education |  |  |  |  |
| *With scores carried forward*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.63 [1.20, 2.21]2.18 [1.66, 2.88]3.35 [2.43, 4.61]3.16 [2.27, 4.41]5.60 [3.47, 9.03]5.13 [3.04, 8.65] | .003< .001< .001< .001< .001< .001 | 2.37 [1.68, 3.33]2.92 [2.11, 4.03]5.31 [3.71, 7.60]5.29 [3.66, 7.65]6.23 [3.54, 10.97]11.31 [6.66, 19.21] | < .001< .001< .001< .001< .001< .001 |
| *Without scores carried forward1*MTA 0.5MTA 1MTA 1.5MTA 2MTA 2.5MTA ≥3 | 1.76 [1.24, 2.49]2.60 [1.90, 3.55]3.98 [2.78, 5.71]3.29 [2.24, 4.83]5.64 [3.28, 9.70]4.78 [2.61, 8.77] | .001< .001< .001< .001< .001< .001 | 2.16 [1.51, 3.09]3.06 [2.19, 2.59]5.38 [3.71, 7.81]5.05 [3.43, 7.44]6.40 [3.57, 11.47]12.20 [7.11, 20.95] | < .001< .001< .001< .001< .001< .001 |

All models use MTA 0 and the group of patients learning all associations on both sets (A+B) as the reference. 1 Excluding the 324 participants who did not achieve a score of 6 on the second trial but were not administered a third set.

*Abbreviations:* MTA, medial temporal lobe atrophy; OR, odds ratio; VAT, Visual Association Test; 95%CI, 95% confidence interval.

**Supplemental Table 6.** Predicting VAT performance based on GCA and Fazekas scores.

| Model | Learned all on VAT A/C,but not on VAT B/D | Did not learn all associations on VAT A/C, nor VAT B/D |
| --- | --- | --- |
| OR [95%CI] | *p* | OR [95%CI] | *p* |
| 1: Unadjusted |  |  |  |  |
| GCA 1GCA 2GCA 3 | 2.74 [2.24, 3.35]3.75 [2.86, 4.91]4.46 [1.60, 12.44] | < .001< .001.004 | 3.23 [2.57, 4.07]4.67 [3.48, 6.27]4.23 [1.31, 13.68] | < .001< .001.016 |
| Fazekas 1Fazekas 2Fazekas 3 | 1.54 [1.25, 1.89]1.67 [1.27, 2.18]1.71 [1.17, 2.50] | < .001< .001.006 | 1.77 [1.41, 2.23]1.85 [1.37, 2.49]2.37 [1.60, 3.50] | < .001< .001< .001 |
| 2: Adjusted for age, sex, and education |  |  |  |  |
| GCA 1GCA 2GCA 3 | 2.06 [1.65, 2.56]2.43 [1.81, 3.27]2.89 [1.01, 8.28] | < .001< .001.048 | 2.67 [2.08, 3.42]3.49 [2.52, 4.83]3.35 [1.01, 11.14] | < .001< .001.048 |
| Fazekas 1Fazekas 2Fazekas 3 | 1.09 [0.87, 1.35]0.93 [0.69, 1.24]0.85 [0.57, 1.28] | .454.597.444 | 1.28 [1.00, 1.63]1.09 [0.79, 1.50]1.26 [0.83, 1.92] | .047.618.277 |

All models use GCA 0 or Fazekas 0 and the group of patients learning all associations on both sets (A+B/C+D) as the reference.

*Abbreviations:* GCA, global cortical atrophy; OR, odds ratio; VAT, Visual Association Test; 95%CI, 95% confidence interval.

**Supplemental Table 7.** Predicting VAT performance based on amyloid status, stratified by VAT version.

| Model | Learned all on VAT A/C,but not on VAT B/D | Did not learn all associations on VAT A/C, nor VAT B/D |
| --- | --- | --- |
| OR [95%CI] | *p* | OR [95%CI] | *p* |
| 1: UnadjustedBoth versionsVAT A+BVAT C+D | 3.71 [3.00, 4.60]3.88 [3.11, 4.83]2.38 [0.94, 6.03] | < .001< .001.075 | 7.12 [5.46, 9.27]7.04 [5.34, 9.27]7.19 [2.68, 19.29] | < .001< .001< .001 |
| 2: Adjusted for age, sex, and educationBoth versionsVAT A+BVAT C+D | 3.38 [2.71, 4.22]3.50 [2.78, 4.41]2.41 [0.94, 6.19] | < .001< .001.075 | 6.35 [4.84, 8.34]6.21 [4.67, 8.26]6.74 [2.44, 18.63] | < .001< .001< .001 |
| 3: Adjusted for age, sex, education, and clinical diagnosisBoth versionsVAT A+BVAT C+D | 1.49 [1.14, 1.94]1.61 [1.23, 2.12]0.19 [0.03, 1.11] | .006.001.073 | 1.90 [1.36, 2.64]1.87 [1.33, 2.64]1.75 [0.45, 6.83] | < .001< .001.289 |

All models use amyloid negative and the group of patients learning all associations on both sets (A+B/C+D) as the reference.

*Abbreviations:* OR, odds ratio; VAT, Visual Association Test; 95%CI, 95% confidence interval.

**Supplemental Table 8.** Predicting VAT performance based on amyloid status, with and without carrying forward of scores.

| Model | Learned all on VAT A,but not on VAT B | Did not learn all associations on VAT A, nor VAT B |
| --- | --- | --- |
| OR [95%CI] | *p* | OR [95%CI] | *p* |
| 1: UnadjustedWith scores carried forwardWithout scores carried forward1 | 3.71 [3.00, 4.60]4.19 [3.29, 5.33] | < .001< .001 | 7.12 [5.46, 9.27]7.76 [5.86, 10.28] | < .001< .001 |
| 2: Adjusted for age, sex, and educationWith scores carried forwardWithout scores carried forward1 | 3.38 [2.71, 4.22]3.96 [3.08, 5.10] | < .001< .001 | 6.35 [4.84, 8.34]7.09 [5.31, 9.47] | < .001< .001 |
| 3: Adjusted for age, sex, education, and clinical diagnosisWith scores carried forwardWithout scores carried forward1 | 1.49 [1.14, 1.94]1.66 [1.23, 2.24] | .006.001 | 1.90 [1.36, 2.64]2.05 [1.45, 2.91] | < .001< .001 |

All models use amyloid negative and the group of patients learning all associations on both sets (A+B) as the reference. 1 Excluding the 324 participants who did not achieve a score of 6 on the second trial but were not administered a third set.

*Abbreviations:* OR, odds ratio; VAT, Visual Association Test; 95%CI, 95% confidence interval.



**Supplemental Figure 1.** Learning curves over VAT-A (red) and VAT-B (blue), stratified by MTA score, among amyloid positive individuals.