**Table A in S1 File. Baseline biomarker predictors of investigator diagnosis of cognitive impairment in participants with MRI data**

|  |  |
| --- | --- |
| **Variable** | **PD Subjects (N = 154)** |
| **Univariate****p-value** | **# Subjects** | **Multivariable Analysis** |
|   | **Missing** | **OR (95% CI)** | **p-value** |
| **CSF Biologics** |   |   |   |
|  Alpha-Synuclein | 0.18 | 4 | - | - |
|  A-Beta 1-42 | 0.15 | 4 | - | - |
|  t-tau | 0.13 | 6 | - | - |
|  p-tau | 0.71 | 6 | - | - |
|  t-tau/A-Beta 1-42 | 0.05 | 6 | - | - |
|  p-tau/A-Beta 1-42 | 0.52 | 6 | - | - |
|  p-tau/t-tau | 0.33 | 8 | - | - |
| **Genetics** |   |   |   |
|  *ApoE4* | 0.77 | 19 | - | - |
|  *GBA* N370S | 0.65 | 12 | - | - |
|  *MAPT* rs17649553 | 0.12 | 11 | - | - |
|  *SNCA* rs3910105 | 0.09 | 11 | - | - |
|  *SNCA* rs356181 | 0.39 | 11 | - | - |
|  *BDNF* val66met | 0.15 | 11 | - | - |
|   *COMT* val158met | 0.15 | 11 | - | - |
| **DAT imaging** |   |   |   |
|  Contralateral Caudate | 0.95 | 3 | - | - |
|  Ipsilateral Caudate | 0.90 | 3 | - | - |
|  Contralateral Putamen | 0.07 | 3 | - | - |
|  Ipsilateral Putamen | 0.34 | 3 | - | - |
| **MRI Volume** |   |   |   |
|  Banks Superior Temporal Sulcus | 0.004 | 4 | NS | NS |
|  Caudal Anterior Orbital | 0.35 | 4 | - | - |
|  Caudal Middle Frontal | 0.003 | 9 | NS | NS |
|  Cuneus | 0.20 | 7 | - | - |
|  Entorhinal | 0.59 | 4 | - | - |
|  Fusiform | <0.001 | 5 | 0.502 (0.240, 1.048) | 0.07 |
|  Inferior Parietal | <0.001 | 6 | NS | NS |
|  Inferior Temporal | 0.006 | 5 | NS | NS |
|  Isthmus Cingulate | 0.74 | 4 | - | - |
|  Lateral Occipital | <0.001 | 7 | 0.558 (0.304, 1.022) | 0.06 |
|  Lateral Orbitofrontal | <0.001 | 4 | 0.234 (0.057, 0.970) | 0.05 |
|  Lingual | 0.12 | 7 | - | - |
|  Medial Orbitofrontal | 0.24 | 9 | - | - |
|  Middle Temporal | 0.002 | 5 | NS | NS |
|  Parahippocampal | 0.54 | 4 | - | - |
|  Paracentral | 0.28 | 6 | - | - |
|  Pars Opercularis | 0.02 | 4 | - | - |
|  Pars Orbitalis | 0.01 | 4 | NS | NS |
|  Pars Triangularis | 0.47 | 4 | - | - |
|  Pericalcarine | 0.40 | 7 | - | - |
|  Postcentral | 0.01 | 6 | NS | NS |
|  Posterior Cingulate | 0.60 | 4 | - | - |
|  Precentral | 0.16 | 9 | - | - |
|  Precuneus | 0.02 | 4 | - | - |
|  Rostral Anterior Cingulate | 0.09 | 4 | - | - |
|  Rostral Middle Frontal | 0.002 | 9 | NS | NS |
|  Superior Frontal | 0.274 | 9 | - | - |
|  Superior Parietal | 0.287 | 6 | - | - |
|  Superior Temporal | <0.001 | 5 | NS | NS |
|  Supramarginal | 0.009 | 6 | NS | NS |
|  Frontal Pole | 0.74 | 9 | - | - |
|  Temporal Pole | 0.69 | 5 | - | - |
|  Transverse Temporal | 0.21 | 4 | - | - |
|  Insula | 0.10 | 4 | - | - |
| **MRI Thickness** |   |   |   |
|  Banks Superior Temporal Sulcus | 0.42 | 0 | - | - |
|  Caudal Anterior Cingulate | 0.03 | 0 | - | - |
|  Caudal Middle Frontal | 0.42 | 5 | - | - |
|  Cuneus | 0.79 | 3 | - | - |
|  Entorhinal | 0.33 | 0 | - | - |
|  Fusiform | 0.03 | 1 | - | - |
|  Inferior Parietal | 0.15 | 2 | - | - |
|  Inferior Temporal | 0.06 | 1 | - | - |
|  Isthmus Cingulate | 0.79 | 0 | - | - |
|  Lateral Occipital | 0.52 | 3 | - | - |
|  Lateral Orbitofrontal | 0.80 | 0 | - | - |
|  Lingual | 0.76 | 3 | - | - |
|  Medial Orbitofrontal | 0.63 | 5 | - | - |
|  Middle Temporal | 0.41 | 1 | - | - |
|  Parahippocampal | 0.74 | 0 | - | - |
|  Paracentral | 0.73 | 2 | - | - |
|  Pars Opercularis | 0.79 | 0 | - | - |
|  Pars Orbitalis | 0.80 | 0 | - | - |
|  Pars Triangularis | 0.24 | 0 | - | - |
|  Pericalcarine | 0.08 | 3 | - | - |
|  Postcentral | 0.28 | 2 | - | - |
|  Posterior Cingulate | 0.48 | 0 | - | - |
|  Precentral | 0.78 | 5 | - | - |
|  Precuneus | 0.74 | 0 | - | - |
|  Rostral Anterior Cingulate | 0.39 | 0 | - | - |
|  Rostral Middle Frontal | 0.53 | 5 | - | - |
|  Superior Frontal | 0.41 | 5 | - | - |
|  Superior Parietal | 0.37 | 2 | - | - |
|  Superior Temporal | 0.59 | 1 | - | - |
|  Supramarginal | 0.37 | 2 | - | - |
|  Frontal Pole | 0.56 | 5 | - | - |
|  Temporal Pole | 0.72 | 1 | - | - |
|  Transverse Temporal | 0.94 | 0 | - | - |
|  Insula | 0.35 | 0 | - | - |
| **MRI DTI Fractional Anisotropy** |   |   |   |
|  Thalamus | 0.92 | 9 | - | - |
|  Caudate Nucleus | 0.17 | 9 | - | - |
|  Putamen | 0.97 | 9 | - | - |
|  Globus Pallidus | 0.24 | 9 | - | - |
|  Substantia Nigra | 0.93 | 9 | - | - |
|  Red Nucleus | 0.43 | 9 | - | - |
|  Midbrain | 0.43 | 9 | - | - |
|  Pons | 0.27 | 9 | - | - |
|  Subthalamic Nucleus | 0.98 | 9 | - | - |
|  Anterior corona radiata | 0.62 | 9 | - | - |
|  Anterior limb of internal capsule | 0.79 | 9 | - | - |
|  Cingulum (Rostral anterior) | 0.74 | 9 | - | - |
|  Cingulum (Posterior) | 0.46 | 9 | - | - |
|  Cingulum (Isthmus) | 0.56 | 9 | - | - |
|  Cingulum (Caudal anterior) | 0.34 | 9 | - | - |
|  Cingulum (parahippocampus) | 0.97 | 9 | - | - |
|  External capsule | 0.33 | 9 | - | - |
|  Fornix (cres) / Stria terminalis | 0.09 | 9 | - | - |
|  Inferior fronto-occipital fasciculus | 0.92 | 9 | - | - |
|  Posterior corona radiata | 0.88 | 9 | - | - |
|  Posterior limb of internal capsule | 0.50 | 9 | - | - |
|  Posterior thalamic radiation (include optic radiation) | 0.38 | 9 | - | - |
|  Retrolenticular part of internal capsule | 0.70 | 9 | - | - |
|  Superior corona radiata | 0.08 | 9 | - | - |
|  Superior fronto-occipital fasciculus | 0.92 | 9 | - | - |
|  Superior longitudinal fasciculus | 0.69 | 9 | - | - |
|  Sagittal stratum/inferior longitudinal fasciculus | 0.09 | 9 | - | - |
|  Uncinate fasciculus | 0.74 | 9 | - | - |
|  Cerebral peduncle | 0.33 | 9 | - | - |
|  Corticospinal tract | 0.98 | 9 | - | - |
|  Inferior cerebellar peduncle | 0.08 | 9 | - | - |
|  Middle cerebellar peduncle | 0.28 | 9 | - | - |
|  Superior cerebellar peduncle | 0.90 | 9 | - | - |
|  Medial lemniscus | 0.42 | 9 | - | - |
|  Pontine crossing tract (a part of MCP) | 0.31 | 9 | - | - |
|  Tapatum | 0.73 | 9 | - | - |
|  Rectus WM | 0.59 | 9 | - | - |
|  Middle fronto-orbital WM | 0.15 | 9 | - | - |
|  Lateral fronto-orbital WM | 0.11 | 9 | - | - |
|  Inferior frontal WM | 0.15 | 9 | - | - |
|  Middle frontal WM | 0.18 | 9 | - | - |
|  Superior frontal WM | 0.17 | 9 | - | - |
|  Precentral WM | 0.15 | 9 | - | - |
|  Postcentral WM | 0.40 | 9 | - | - |
|  Superior parietal WM | 0.29 | 9 | - | - |
|  Supramarginal WM | 0.51 | 9 | - | - |
|  Angular WM | 0.14 | 9 | - | - |
|  Precuneus WM | 0.85 | 9 | - | - |
|  Superior occipital WM | 0.13 | 9 | - | - |
|  Middle occipital WM | 0.03 | 9 | - | - |
|  Inferior occipital WM | 0.08 | 9 | - | - |
|  Cuneus WM | 0.69 | 9 | - | - |
|  Lingual WM | 0.37 | 9 | - | - |
|  Fusiform WM | 0.38 | 9 | - | - |
|  Superior temporal WM | 0.28 | 9 | - | - |
|  Middle temporal WM | 0.68 | 9 | - | - |
|  Inferior temporal WM | 0.45 | 9 | - | - |
|  Genu of corpus callosum | 0.97 | 9 | - | - |
|  Body of corpus callosum | 0.92 | 9 | - | - |
|  Splenium of corpus callosum | 0.59 | 9 | - | - |
|  Fornix | 0.55 | 9 | - | - |
| **MRI DTI Mean Diffusivity** |   |  |  |  |
|  Thalamus | 0.09 | 9 | - | - |
|  Caudate Nucleus | 0.17 | 9 | - | - |
|  Putamen | 0.49 | 9 | - | - |
|  Globus Pallidus | 0.47 | 9 | - | - |
|  Substantia Nigra | 0.76 | 9 | - | - |
|  Red Nucleus | 0.25 | 9 | - | - |
|  Midbrain | 0.91 | 9 | - | - |
|  Pons | 0.63 | 9 | - | - |
|  Subthalamic Nucleus | 0.44 | 9 | - | - |
|  Anterior corona radiata | 0.94 | 9 | - | - |
|  Anterior limb of internal capsule | 0.91 | 9 | - | - |
|  Cingulum (Rostral anterior) | 0.19 | 9 | - | - |
|  Cingulum (Posterior) | 0.09 | 9 | - | - |
|  Cingulum (Isthmus) | 0.39 | 9 | - | - |
|  Cingulum (Caudal anterior) | 0.54 | 9 | - | - |
|  Cingulum (parahippocampus) | 0.84 | 9 | - | - |
|  External capsule | 0.04 | 9 | - | - |
|  Fornix (cres) / Stria terminalis | 0.10 | 9 | - | - |
|  Inferior fronto-occipital fasciculus | 0.43 | 9 | - | - |
|  Posterior corona radiata | 0.32 | 9 | - | - |
|  Posterior limb of internal capsule | 0.71 | 9 | - | - |
|  Posterior thalamic radiation (include optic radiation) | 0.78 | 9 | - | - |
|  Retrolenticular part of internal capsule | 0.10 | 9 | - | - |
|  Superior corona radiata | 0.84 | 9 | - | - |
|  Superior fronto-occipital fasciculus | 0.77 | 9 | - | - |
|  Superior longitudinal fasciculus | 0.72 | 9 | - | - |
|  Sagittal stratum/inferior longitudinal fasciculus | 0.31 | 9 | - | - |
|  Uncinate fasciculus | 0.22 | 9 | - | - |
|  Cerebral peduncle | 0.04 | 9 | - | - |
|  Corticospinal tract | 0.75 | 9 | - | - |
|  Inferior cerebellar peduncle | 0.01 | 9 | 0.113 (0.023, 0.563)\* | 0.008 |
|  Middle cerebellar peduncle | 0.47 | 9 | - | - |
|  Superior cerebellar peduncle | 0.29 | 9 | - | - |
|  Medial lemniscus | 0.47 | 9 | - | - |
|  Pontine crossing tract (a part of MCP) | 0.56 | 9 | - | - |
|  Tapatum | 0.10 | 9 | - | - |
|  Rectus WM | 0.91 | 9 | - | - |
|  Middle fronto-orbital WM | 0.69 | 9 | - | - |
|  Lateral fronto-orbital WM | 0.78 | 9 | - | - |
|  Inferior frontal WM | 0.07 | 9 | - | - |
|  Middle frontal WM | 0.13 | 9 | - | - |
|  Superior frontal WM | 0.60 | 9 | - | - |
|  Precentral WM | 0.09 | 9 | - | - |
|  Postcentral WM | 0.61 | 9 | - | - |
|  Superior parietal WM | 0.17 | 9 | - | - |
|  Supramarginal WM | 0.58 | 9 | - | - |
|  Angular WM | 0.08 | 9 | - | - |
|  Precuneus WM | 0.01 | 9 | NS | NS |
|  Superior occipital WM | 0.10 | 9 | - | - |
|  Middle occipital WM | 0.08 | 9 | - | - |
|  Inferior occipital WM | 0.16 | 9 | - | - |
|  Cuneus WM | 0.02 | 9 | - | - |
|  Lingual WM | 0.11 | 9 | - | - |
|  Fusiform WM | 0.27 | 9 | - | - |
|  Superior temporal WM | 0.52 | 9 | - | - |
|  Middle temporal WM | 0.68 | 9 | - | - |
|  Inferior temporal WM | 0.55 | 9 | - | - |
|  Genu of corpus callosum | 0.62 | 9 | - | - |
|  Body of corpus callosum | 0.15 | 9 | - | - |
|  Splenium of corpus callosum | 0.81 | 9 | - | - |
|  Fornix | 0.07 | 9 | - | - |

\*OR for 0.1 unit increase.

Note: All analyses adjust for age, gender, race, education level, baseline MDS-UPDRS motor score, baseline psychosis, and baseline RBD, with nested random effects for subjects within sites.