

# Supplementary Materials

## S1 Iron analysis of 36 brain regions

**Table 1.** The discrepancy in brain iron quantitative analysis (mean  $\pm$  std in ppb) between mQSM segmentation and registration methods.

Brain region	Ground truth	mQSM	FLIRT	NiftyReg	ANTs
frontal lobe (L)	4.61 $\pm$ 0.44	4.7 $\pm$ 0.45	**2.83 $\pm$ 0.28	**2.94 $\pm$ 0.29	**3.23 $\pm$ 0.28
frontal lobe (R)	5.08 $\pm$ 0.46	5.22 $\pm$ 0.46	**2.77 $\pm$ 0.31	**3.18 $\pm$ 0.28	**3.48 $\pm$ 0.29
gyrus cinguli (L)	5.23 $\pm$ 1.04	5.21 $\pm$ 1.03	5.7 $\pm$ 0.87	5.52 $\pm$ 0.92	5.76 $\pm$ 0.92
gyrus cinguli (R)	5.83 $\pm$ 0.88	5.74 $\pm$ 0.91	6.08 $\pm$ 0.81	6.09 $\pm$ 0.81	6.53 $\pm$ 0.87
insular lobe (L)	-6.12 $\pm$ 0.89	-6.03 $\pm$ 0.88	-5.8 $\pm$ 0.99	-6.28 $\pm$ 0.92	*-4.21 $\pm$ 0.84
insular lobe (R)	-6.86 $\pm$ 0.80	-6.93 $\pm$ 0.78	-7.33 $\pm$ 0.90	-6.99 $\pm$ 0.82	-5.65 $\pm$ 0.78
lateral temporal (L)	-1.56 $\pm$ 0.54	-1.71 $\pm$ 0.56	-1.04 $\pm$ 0.36	-0.99 $\pm$ 0.36	-0.62 $\pm$ 0.36
lateral temporal (R)	-2.36 $\pm$ 0.51	-2.48 $\pm$ 0.54	**0.92 $\pm$ 0.35	**0.9 $\pm$ 0.37	**0.74 $\pm$ 0.36
medial temporal (L)	-2.17 $\pm$ 0.67	-2.06 $\pm$ 0.66	-2.16 $\pm$ 0.58	-1.98 $\pm$ 0.63	**0.34 $\pm$ 0.59
medial temporal (R)	-2.21 $\pm$ 0.72	-2.12 $\pm$ 0.73	-1.51 $\pm$ 0.73	-1.31 $\pm$ 0.79	*-0.21 $\pm$ 0.74
occipital lobe (L)	2.0 $\pm$ 0.40	2.25 $\pm$ 0.43	**0.78 $\pm$ 0.29	**0.69 $\pm$ 0.28	**0.58 $\pm$ 0.30
occipital lobe (R)	2.31 $\pm$ 0.39	2.55 $\pm$ 0.41	**0.61 $\pm$ 0.26	**0.43 $\pm$ 0.28	**0.11 $\pm$ 0.27
parietal lobe (L)	4.33 $\pm$ 0.37	4.57 $\pm$ 0.39	**2.07 $\pm$ 0.19	**2.16 $\pm$ 0.19	**2.43 $\pm$ 0.21
parietal lobe (R)	4.71 $\pm$ 0.28	4.96 $\pm$ 0.29	**2.3 $\pm$ 0.14	**2.42 $\pm$ 0.13	**2.71 $\pm$ 0.17
cerebellum gray matter (L)	-8.16 $\pm$ 0.37	-8.83 $\pm$ 0.42	**6.0 $\pm$ 0.31	**6.31 $\pm$ 0.32	**6.21 $\pm$ 0.32
cerebellum gray matter (R)	-8.64 $\pm$ 0.35	-9.4 $\pm$ 0.41	**6.2 $\pm$ 0.28	**6.47 $\pm$ 0.31	**6.67 $\pm$ 0.29
cerebellum white matter (L)	-8.11 $\pm$ 0.58	-8.28 $\pm$ 0.58	**1.57 $\pm$ 0.59	**1.46 $\pm$ 0.56	**1.99 $\pm$ 0.57
cerebellum white matter (R)	-8.47 $\pm$ 0.65	-8.77 $\pm$ 0.62	**1.83 $\pm$ 0.61	**1.48 $\pm$ 0.60	**2.31 $\pm$ 0.59
caudate (L)	27.73 $\pm$ 2.26	27.88 $\pm$ 2.21	23.48 $\pm$ 2.23	22.47 $\pm$ 2.39	24.7 $\pm$ 2.05
caudate (R)	30.72 $\pm$ 2.44	31.81 $\pm$ 2.42	29.73 $\pm$ 2.51	31.64 $\pm$ 2.52	32.11 $\pm$ 2.33
putamen (L)	30.61 $\pm$ 3.11	31.22 $\pm$ 3.11	*23.96 $\pm$ 2.47	24.92 $\pm$ 2.52	**21.52 $\pm$ 2.50
putamen (R)	29.59 $\pm$ 2.82	30.23 $\pm$ 2.79	**20.99 $\pm$ 2.38	*23.61 $\pm$ 2.34	**17.28 $\pm$ 2.36
pallidum (L)	79.78 $\pm$ 3.91	81.27 $\pm$ 4.01	**60.46 $\pm$ 6.14	70.29 $\pm$ 5.77	**64.9 $\pm$ 5.24
pallidum (R)	81.12 $\pm$ 3.71	82.47 $\pm$ 3.68	76.52 $\pm$ 6.44	*71.12 $\pm$ 6.18	78.83 $\pm$ 4.87
thalamus (L)	-2.42 $\pm$ 1.35	-2.27 $\pm$ 1.37	-2.37 $\pm$ 1.03	-3.11 $\pm$ 1.09	-1.87 $\pm$ 0.95
thalamus (R)	-1.14 $\pm$ 1.23	-1.13 $\pm$ 1.23	-2.11 $\pm$ 0.94	*-2.79 $\pm$ 0.94	-1.43 $\pm$ 0.84
accumbens area (L)	-36.39 $\pm$ 3.61	-37.19 $\pm$ 3.79	**19.22 $\pm$ 5.26	**17.21 $\pm$ 4.96	-29.41 $\pm$ 4.26
accumbens area (R)	-33.34 $\pm$ 3.52	-33.37 $\pm$ 3.40	**8.37 $\pm$ 5.32	**13.42 $\pm$ 4.81	*-24.2 $\pm$ 4.25
ventral diencephalon (L)	-15.81 $\pm$ 1.68	-16.46 $\pm$ 1.59	**7.66 $\pm$ 1.07	**7.42 $\pm$ 1.10	**2.06 $\pm$ 0.84
ventral diencephalon (R)	-16.01 $\pm$ 0.93	-16.5 $\pm$ 0.97	**7.29 $\pm$ 1.06	**7.4 $\pm$ 1.11	**1.33 $\pm$ 0.79
red nucleus (L)	101.56 $\pm$ 4.28	103.1 $\pm$ 4.14	98.1 $\pm$ 4.26	96.1 $\pm$ 4.47	107.1 $\pm$ 3.89
red nucleus (R)	107.3 $\pm$ 4.66	109.19 $\pm$ 4.51	102.19 $\pm$ 4.50	99.19 $\pm$ 3.96	101.19 $\pm$ 4.05
substantia nigra (L)	102.98 $\pm$ 4.41	105.95 $\pm$ 4.12	*80.43 $\pm$ 4.25	*82.84 $\pm$ 3.94	86.73 $\pm$ 4.16
substantia nigra (R)	108.48 $\pm$ 4.33	110.98 $\pm$ 4.04	*83.57 $\pm$ 3.85	*85.07 $\pm$ 3.74	88.58 $\pm$ 4.26
dentate nucleus (L)	66.71 $\pm$ 3.67	66.94 $\pm$ 3.65	68.25 $\pm$ 4.05	63.54 $\pm$ 4.12	65.26 $\pm$ 3.84
dentate nucleus (R)	67.4 $\pm$ 3.63	67.77 $\pm$ 3.46	69.34 $\pm$ 4.16	64.26 $\pm$ 4.06	66.14 $\pm$ 3.76

\*\* $p \leq 0.01$  and \* $: 0.01 < p \leq 0.05$  reference to the ground truth.