Relationship between regional brain volumes and age as well as significance of nonlinearity

Brain Regions[a]	Control eDF	Control F_{age}	sMCI eDF	sMCI F_{age}	cMCI eDF	cMCI F_{age}	AD eDF	AD F_{age}	Nonlinearity $F_{nonlinear}$	Nonlinearity p
Global Measures										
Lateral ventricles	1.9	$22.2^{\ddagger}$	2.3	$45.2^{\ddagger}$	1.3	$33.5^{\ddagger}$	1.5	$35.7^{\ddagger}$	7.1	8.0×10^{-3}
Inferior lateral ventricles	1.7	$25.7^{\ddagger}$	2.2	$43.1^{\ddagger}$	2.2	$46.6^{\ddagger}$	2.0	$29.4^{\ddagger}$	6.9	8.6×10^{-3}
Total white matter	1.7	$23.5^{\ddagger}$	2.2	$40.2^{\ddagger}$	1.9	$18.7^{\dagger}$	2.0	$18.3^{\dagger}$	5.5	9.2×10^{-3}
Total gray matter	1.8	$45.9^{\ddagger}$	2.0	$30.7^{\ddagger}$	1.9	$9.1^{\$}$	1.2	0.6^{ns}	5.3	1.1×10^{-2}
Third ventricle	1.6	$47.3^{\ddagger}$	2.0	$93.0^{\ddagger}$	1.7	$14.5^{\dagger}$	1.7	$11.4^{\dagger}$	4.6	ns
Fourth ventricle	1.3	1.9^{ns}	1.8	5.9^{ns}	1.5	2.6^{ns}	1.5	2.8^{ns}	2.4	ns
Temporal Lobe										
Parahippocampal gyrus	1.9	$9.3^{\$}$	1.6	$18.7^{\$}$	1.3	2.4^{ns}	1.4	$14.4^{\dagger}$	14.9	3.6×10^{-5}
Fusiform gyrus	1.6	$31.2^{\ddagger}$	1.3	$17.1^{\dagger}$	1.2	$16.8^{\dagger}$	1.0	2.6^{ns}	14.1	7.0×10^{-4}
Hippocampus	1.7	$44.5^{\ddagger}$	2.4	$37.8^{\ddagger}$	1.8	$25.6^{\ddagger}$	2.1	$27.3^{\ddagger}$	12.2	4.6×10^{-5}
Transverse temporal GM	1.9	$20.5^{\ddagger}$	2.2	$9.7^{\dagger}$	2.0	$20.7^{\ddagger}$	1.3	$12.2^{\dagger}$	9.9	1.9×10^{-3}
Entorhinal cortex	1.7	5.5^{ns}	1.4	$18.8^{\dagger}$	1.3	$12.9^{\dagger}$	1.4	$22.6^{\ddagger}$	9.2	1.0×10^{-2}
Lingual temporal lobe	1.2	8.0^{ns}	1.5	$9.4^{\$}$	1.1	0.4^{ns}	1.1	1.8^{ns}	7.1	1.0×10^{-2}
Superior temporal GM	1.9	$33.6^{\ddagger}$	1.4	$9.6^{\dagger}$	1.9	$27.0^{\ddagger}$	1.3	6.9^{ns}	4.3	ns

Amygdala	1.6	47.6‡	1.9	3.2^{ns}	1.6	4.4^{ns}	1.7	6.8^{ns}	3.6	ns
Temporal pole	0.9	0.6^{ns}	1.3	0.8^{ns}	1.3	2.5^{ns}	1.3	2.5^{ns}	3.2	ns
Posterior Lobe										
Paracentral	1.3	12.5†	1.4	19.5†	1.1	3.8^{ns}	1.1	8.9$^{\$}$	7.3	1.0×10^{-2}
Postcentral	1.3	17.5†	1.4	30.3‡	1.1	0.6^{ns}	1.1	3.4$^{\$}$	7.2	1.0×10^{-2}
Posterior cingulate	1.9	31.1‡	1.4	13.7‡	1.9	9.4†	1.0	0.1^{ns}	5.8	ns
Supramarginal	1.6	39.2‡	1.8	7.1$^{\$}$	1.5	0.6^{ns}	1.5	3.2^{ns}	4.6	ns
Precuneus	1.7	15.1†	2.2	21.5‡	1.8	5.1^{ns}	1.9	0.7^{ns}	4.3	ns
Superior parietal	1.7	30.4†	2.4	13.5†	2.0	1.9^{ns}	1.8	1.0^{ns}	4.0	ns
Istmus cingulate	1.0	18.4†	1.2	14.3†	1.0	11.1$^{\$}$	1.0	12.6$^{\$}$	2.5	ns
Frontal Lobe										
Precentral GM	1.8	60.0‡	2.1	50.1‡	1.8	14.6‡	1.7	10.1†	5.7	ns
Caudal middle frontal	1.6	8.7$^{\$}$	1.8	6.6^{ns}	1.6	5.0^{ns}	1.5	2.6^{ns}	5.3	ns
Lateral orbitofrontal GM	1.3	25.9‡	1.7	82.3‡	1.4	21.7‡	1.4	13.2†	4.9	ns
Pars opercularis	1.3	24.6‡	1.6	8.1$^{\$}$	1.3	1.8^{ns}	1.4	8,2$^{\$}$	4.6	ns
Medial orbitofrontal GM	1.3	12.1†	1.6	58.2‡	1.4	13.6†	1.4	19.3†	4.5	ns
Rostal orbitofrontal	1.9	30.6‡	2.2	8.7$^{\$}$	2.0	12.6†	1.5	6,5$^{\$}$	4.3	ns
Frontal pole	1.2	12.5†	1.3	3.7^{ns}	1.0	0.2^{ns}	1.0	5.4^{ns}	3.9	ns
Rostal anterior cingulate	1.3	1.7^{ns}	1.2	1.4^{ns}	1.2	2.6^{ns}	1.3	3.5^{ns}	2.6	ns
Caudal anterior cingulate	1.3	1.3^{ns}	1.1	0.9^{ns}	1.1	1.0^{ns}	1.0	1.6^{ns}	2.5	ns

Region	eDF	F_{age}	eDF	F_{age}	eDF	F_{age}	eDF	F_{age}	$F_{nonlinear}$	$p_{nonlinear}$
Inferior parietal GM	1.2	48.9‡	1.6	14.6†	1.3	3.2ns	1.0	2.0ns	1.5	ns
Superior frontal GM	1.8	41.1‡	1.9	22.2‡	1.8	23.7‡	1.7	11.9†	0.9	ns
Occipital lobe										
Lateral occipital	1.3	7.3ns	1.5	6.2ns	1.4	7.2ns	1.1	0.2ns	3.8	ns
Cuneus	1.2	5.4ns	1.3	1.0ns	1.0	0.1ns	1.2	4.4ns	2.6	ns
Subcortical regions										
Nucleus accumbens	1.9	17.1‡	2.3	10.7†	2.0	10.9†	2.0	7.0†	5.9	ns
Putamen	1.7	3.7ns	2.3	4.7ns	2.0	3.9ns	1.9	1.7ns	4.1	ns
Thalamus	1.3	22.8‡	1.6	40.0‡	1.3	16.3†	1.4	16.0†	3.5	ns
Pallidum	1.4	4.0ns	1.9	5.4ns	1.5	4.6ns	1.9	2.5ns	3.1	ns
Caudate	1.0	1.1ns	1.1	10.7ns	1.0	0.9ns	1.3	12.3ns	2.5	ns

eDF: extra degrees of freedom, an index of nonlinearity where a value larger than unity indicates the deviation from linearity.

F_{age}: F-value of age dependence test;

P-value levels of age tests: ns = not significant; \$: $p = 0.05$; †: $p = 0.01$; ‡: $p = 0.001$;

$F_{nonlinear}$: F-value of nonlinearity test;

$p_{nonlinear}$ = p-value of nonlinearity test;

GM: Gray matter;

(a) The anatomical correspondence of the regions is shown in the brain map below;

Brain map illustrating the anatomical region used in the analysis