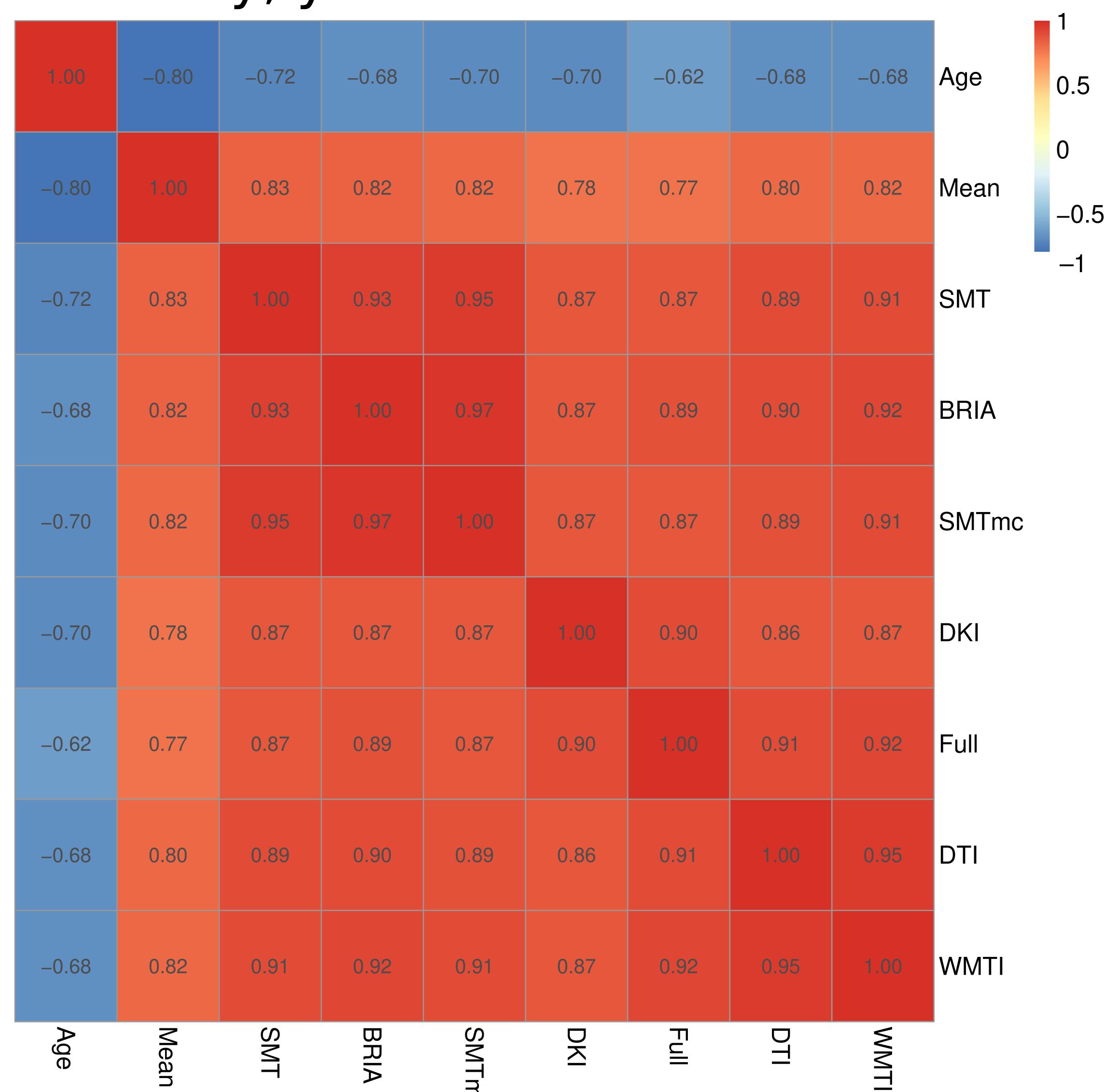


Fornix and forceps are key regions of white matter brain age

Brain-wide associations between white matter and age highlight the role of fornix microstructure in brain ageing

Background: Unveiling the details of white matter maturation throughout ageing is a fundamental question for understanding the ageing brain. In an extensive comparison of brain age predictions and age-associations of WM features from different diffusion approaches, we analyzed UK Biobank diffusion magnetic resonance imaging data across midlife and older age ($N = 35,749$, 44.6–82.8 years of age).

Result 1: Conventional and advanced diffusion MRI approaches predict brain age consistently, yet best when combined.

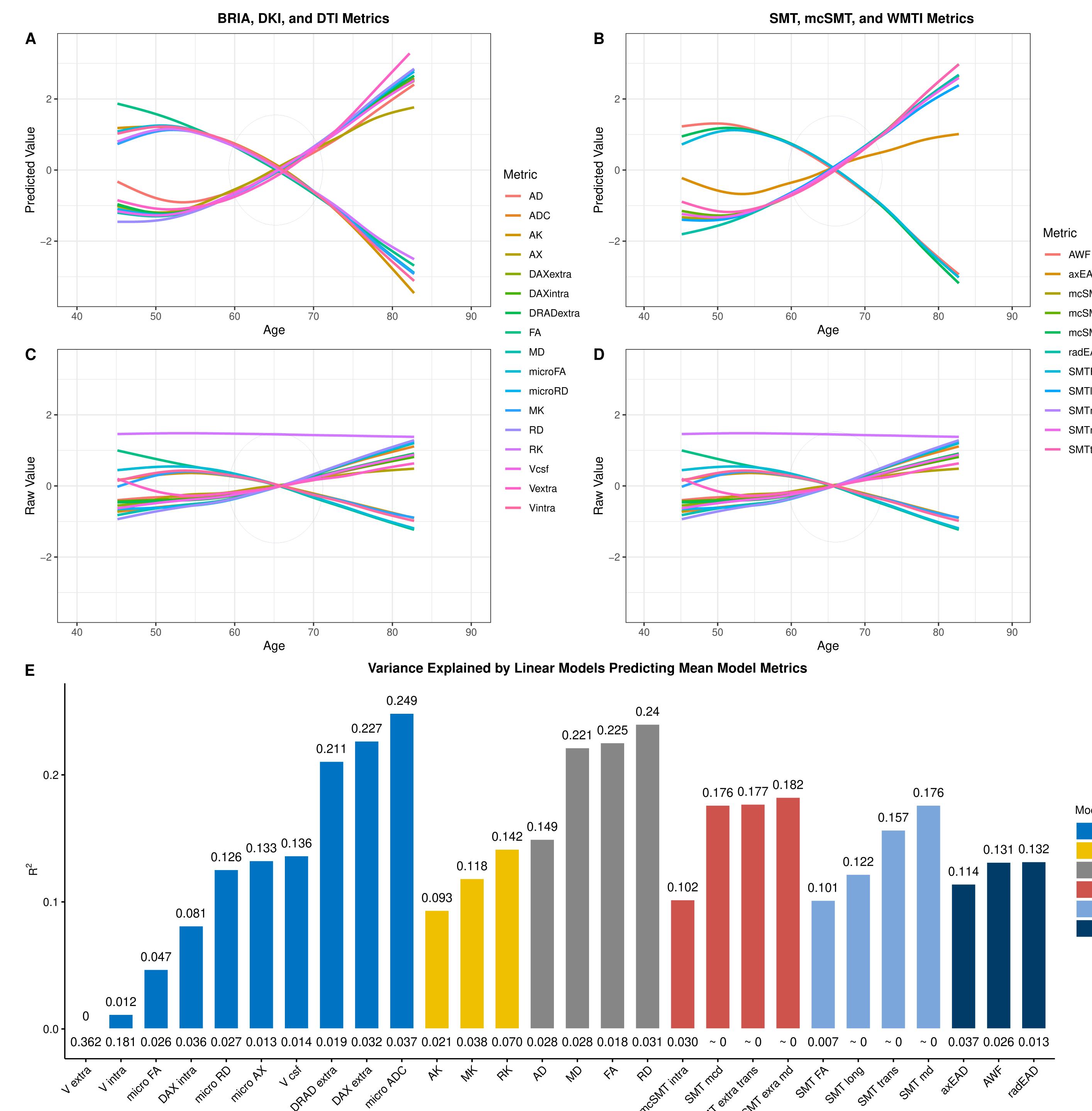


Correlations of uncorrected brain age gap and age across used diffusion approaches. Full = all data combined. Mean = multimodal whole-brain averaged metrics.

Result 2: Fornix and forceps minor features explained most variance in age across diffusion approaches.

BRIA	DKI	DTI	SMT	mcSMT	WMTI	Multimodal
Micro FA fornix 0.1954±0.0027	AK right anterior limb of internal capsule 0.0984±0.0014	MD fornix 0.0712±0.0013	MD fornix 0.0795±0.0018	Extratrans fornix 0.0498±0.0013	AWF fornix 0.1699±0.0023	Micro FA fornix 0.0914±0.0011
Vextra forceps minor 0.0278±0.0007	RK fornix 0.0884±0.0016	FA forceps minor 0.0533±0.0011	FA right superior longitudinal fasciculus 0.0267±0.0007	Intra forceps minor 0.0444±0.0009	radEAD fornix to right striaterminalis 0.0283±0.0007	AK anterior limb of internal capsule 0.0055±0.0011
Vextra body of the corpus callosum 0.0261±0.0007	MK left external capsule 0.0259±0.0006	RD fornix to right Striaterminalis 0.0462±0.0009	Longitudinal fornix 0.0251±0.0006	Intra fornix 0.0289±0.0009	AWF forceps minor 0.0194±0.0005	FA forceps minor 0.0219±0.0006
Micro FA fornix to right Striaterminalis 0.0203±0.0006	MK right superior longitudinal fasciculus 0.0214±0.0006	FA right superior cerebellar peduncle 0.0221±0.0006	Trans fornix to right Striaterminalis 0.0204±0.0006	Extratrans fornix to right Striaterminalis 0.0201±0.0006	axEAD forceps minor 0.0193±0.0007	RD right fornix stria terminalis 0.0214±0.0006
Vintra right superior cerebellar peduncle 0.0194±0.0006	RK forceps minor 0.0208±0.0005	FA body of the corpus callosum 0.0218±0.0006	FA fornix 0.0192±0.0006	Extratrans right external capsule 0.0163±0.0007	axEAD left posterior limb of internal capsule 0.0173±0.0006	AK Genu corpus callosum 0.0095±0.0003

Result 3: We present general patterns of white matter deterioration for higher ages in fornix, forceps minor, and across the brain.



Panels A-D show age curves for each standardized (z-score) diffusion metric's mean skeleton value (y-axis) plotted as a function of age (x-axis). Diffusion metrics in panels A-B were corrected for sex and scanner site.

Conclusion: We encourage the application of multiple dMRI approaches for detailed insights into WM, and the further investigation of fornix and forceps as potential biomarkers of brain age and ageing.

