

# **Brain structural complexity and life course cognitive change**

## **Abstract**

Fractal measures such as fractal dimension (FD) can quantify the structural complexity of the brain. These have been used in clinical neuroscience to investigate brain development, ageing and in studies of psychiatric and neurological disorders. Here, we examined associations between the FD of white matter and cognitive changes across the life course in the absence of detectable brain disease. The FD was calculated from segmented cerebral white matter MR images in 217 subjects aged about 68. years, in whom archived intelligence scores from age 11. years were available. Cognitive test scores of fluid and crystallised intelligence were obtained at the time of MR imaging. Significant differences were found (intracranial volume, brain volume, white matter volume and Raven's Progressive Matrices score) between men and women at age 68. years and novel associations were found between FD and measures of cognitive change over the life course from age 11 to 68. years. Those with greater FD were found to have greater than expected fluid abilities at age 68. years than predicted by their childhood intelligence and less cognitive decline from age 11 to 68. years. These results are consistent with other reports that FD measures of cortical structural complexity increase across the early life course during maturation of the cerebral cortex and add new data to support an association between FD and cognitive ageing.