**Instruction to use the software**

The following four files are included in this software package. The first two are MATLAB files and the last two are shell scripts.

* 1. ‘multimodal\_cross\_validation\_crosssectional’– The code used for multimodal analysis of cross-sectional data with up to five measures (brain Fsum, brain FA, cortical thickness, spine FA at C2-CST, and spine CSA at C2). This will help to reproduce the results presented in Table 3 in the main paper.
  2. ‘multimodal\_cross\_validation\_longitudinal’– The code used for multimodal analysis of longitudinal data with up to six measures (brain Fsum, brain FA, cortical thickness, spine FA at C2-CST, spine CSA at C2, brain FDC). This will help to reproduce the results presented in Table 5 in the main paper.
  3. ‘mrRuns\_crosssectional’- The code used for cross-sectional Fixel- Based Analysis (FBA). The design (design\_matrix\_cross.txt) and contrast (contrast\_matrix\_cross.txt) files, and the text file with data filenames (files\_cross.txt) are also included.
  4. ‘mrRuns\_longitudinal’- The code used for longitudinal FBA. The design (design\_matrix\_long.txt) and contrast (contrast\_matrix\_long.txt) files, and the text file with data filenames (files\_long.txt) are also included.

The other major tool we used to get the results presented in the paper is the FSL-based tract-based spatial statistics (TBSS). Readers may follow the instructions in the TBSS user guide (<https://fsl.fmrib.ox.ac.uk/fsl/fslwiki/TBSS/UserGuide>) to reproduce those results.