**Steps used for analyzing fMRI images corresponding to the ABCD datasets.**

**Extracting nuisance signals:**

Signals: WM, CSF, global average time series and six-dimensional motion parameters

Register MNI template to a reference image (first image or mean of the time series) from the fMRI time series. The registration is performed using FLIRT and FNIRT. Using the saved warped fields, the white matter and CSF corresponding to the MNI template are transformed to the functional space. Then white matter and CSF masks are generated, which are applied on the functional data to extract the time series. The time series corresponding to the white matter and CSF are averaged and saved alongside the global average of the time series from all voxels in an excel sheet. The six-dimensional motion parameters, which are estimated using SimpleITK, corresponding to every volume are also saved. This csv file is then passed as an argument to a Nifti spheres masker object in Nilearn for nuisance signal regression.

**Transform atlas coordinates to functional space:**

Time series are extracted from spheres drawn around the coordinates (in the functional space) and averaged. Correlation matrix is generated from the averaged time series.

**Transformation procedure**: The coordinates (e.g., from power’s atlas) are transformed to those in the functional space using the affine transforms and the warp fields (if non-linear registration is involved) generated. Specifically, the coordinates are transformed from the MNI space to the functional space via the Structural (T1) space.

Please refer to the flowchart below for how the transformation works. When only rigid registration using FLIRT is employed, the relationship between a coordinate in fMRI space and a coordinate in Atlas space is given inside the green box. However, when non-rigid registration is employed, in addition to affine matrices, warp fields are used in the transformation. Specifically, the warp field (WA) generated as part of registration between the atlas and T1 is defined in the structural (T1) voxel coordinate space and the warp field (WB) generated as part of registration between T1 and fMRI data is defined in the fMRI voxel coordinate space.

If other registration packages are used, then the specific convention must be adopted, and the matrices used in the transformation would be different.

**Drawing spheres with the coordinates as center:**

**(Spatial smoothing, Band pass filtering, Detrending and Standardizing)**

Before generating the time series for correlation matrix calculation, the fMRI data undergoes spatial smoothing, band pass filtering, detrending and standardizing. All of this is achieved by creating a masker object in Nilearn. Application of the masker object on the fMRI data results in the application of the above operations on the fMRI data. The averaged time series from spheres drawn around each coordinate are then extracted for region-to-region correlation matrix calculations.

**Compute and save correlation matrix:**

Time series are extracted from the seed points and averaged. Region-to-Region correlation matrix is then computed and saved.