**MESA Exam 6 Ancillary Study 253 Data Set Variable Guide**

Brain MRI – FA Eve

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| **Data Set name :** | MESAe6as253\_BrainMRIFAEve\_20240108 |
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**MESA Ancillary study #253, Atrial Fibrillation Study**

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See ancillary study publications1,2 in the Reference list for information on ancillary study methods and for examples of how to analyze the brain MRI data. Please acknowledge the Atrial Fibrillation Ancillary Study funding in all publications that use these brain MRI data: R01 HL127659 from the National Heart, Lung, and Blood Institute.

MESA participants from all six field centers who participated in the Atrial Fibrillation ancillary study3,4 at Exam 6 were invited to complete a brain MRI a median (IQR) of 18 (16, 20) months after the Exam 6 visit. This data set contains one record per ancillary study participant (n=1062) who had a brain MRI in March 2018 through August 2019 as part of the Atrial Fibrillation ancillary study. The Brain MRI Reading Center at the University of Pennsylvania provided this Fractional Anisotropy (FA) dataset, which includes FA calculated from axial 2D echo-planar diffusion-tensor imaging (DTI) using automated pipelines5 and reported for Eve regions of interest (ROIs)6. FA reflects the degree to which water diffusion is limited to a single dimension and is a scalar ranging from 0, indicating equivalent motion in all directions, to 1, indicating motion restricted to a single direction. Decreased white matter (WM) FA is interpreted as indicating reduced WM microstructural integrity, which is a feature of small vessel disease.

QC codes:

The variable qc\_code contains quality control information. The values and their explanations are as follows:

L1 incidental findings detected in initial manual reading; structural brain lesion was present that should not affect regional volumes, either normal or abnormal

L2 incidental findings detected in initial manual reading; structural brain lesion was present that should not affect normal regional volumes, but abnormal volumes may be affected

L3 incidental findings detected in initial manual reading; structural brain lesion was present that may affect both normal and abnormal regional volumes.

QC\_I\_T1\_1 or QC\_I\_T1\_2 scans with image quality issues, such as “missing parts of brain” and “moderate motion”

QC\_I\_DTI\_1 scans with no DTI sequence data available

NA no qc issues

Comments regarding the qc\_code value are found in qc\_note.

Exclusions: for analysis of FA, analysts must exclude scans with the following qc\_codes:

L3 (n=15)

QC\_I\_T1\_1 (n=1)

QC\_I\_T1\_2 (n=1)

QC\_I\_DTI\_1 (n=4)

For these 21 participants, the variable fa\_exclude is set to 1 and all FA variables have been set to missing.

Analysts may also wish to exclude in a sensitivity analyses those with qc\_code = L2 (n=2).

Analysis recommendations: All brain MRI analyses in MESA should be adjusted for field center. For analyses of subregions or tracts, it is recommended to use this FA Eve dataset. The Eve atlas is a probabilistic white matter tract/ROI atlas. This is an estimation of structure that is more physiological relative to white matter organization. The Eve ROIs are often small, which can increase errors/measurement variability. Also the atlas does not directly measure tracts or account for crossing fibers, so there could be errors in the location of tracts. For analyses focused on global or lobar WM integrity, use FA variables from the separate FA\_MUSE dataset.

**References**

1. Austin TR, Nasrallah IM, Erus G, Desiderio LM, Chen LY, Greenland P, Harding BN, Hughes TM, Jensen PN, Longstreth WT, Jr., et al. Association of Brain Volumes and White Matter Injury With Race, Ethnicity, and Cardiovascular Risk Factors: The Multi-Ethnic Study of Atherosclerosis. *Journal of the American Heart Association*. 2022;11:e023159. doi: 10.1161/JAHA.121.023159

2. Austin TR, Jensen PN, Nasrallah IM, Habes M, Rashid T, Ware JB. Left Atrial Function and Arrhythmias in Relation to Small Vessel Disease on Brain MRI: the Multi-Ethnic Study of Atherosclerosis. (under review).

3. Heckbert SR, Austin TR, Jensen PN, Chen LY, Post WS, Floyd JS, Soliman EZ, Kronmal RA, Psaty BM. Differences by race/ethnicity in the prevalence of clinically detected and monitor-detected atrial fibrillation: MESA. *Circulation Arrhythmia and electrophysiology*. 2020;13:e007698. doi: 10.1161/CIRCEP.119.007698

4. Heckbert SR, Austin TR, Jensen PN, Floyd JS, Psaty BM, Soliman EZ, Kronmal RA. Yield and consistency of arrhythmia detection with patch electrocardiographic monitoring: The Multi-Ethnic Study of Atherosclerosis. *J Electrocardiol*. 2018;51:997-1002.

5. Haight T, Nick Bryan R, Erus G, Hsieh MK, Davatzikos C, Nasrallah I, D'Esposito M, Jacobs DR, Jr., Lewis C, Schreiner P, et al. White matter microstructure, white matter lesions, and hypertension: An examination of early surrogate markers of vascular-related brain change in midlife. *Neuroimage Clin*. 2018;18:753-761. doi: 10.1016/j.nicl.2018.02.032

6. Mori S, Oishi K, Jiang H, Jiang L, Li X, Akhter K, Hua K, Faria AV, Mahmood A, Woods R, et al. Stereotaxic white matter atlas based on diffusion tensor imaging in an ICBM template. *Neuroimage*. 2008;40:570-582. doi: 10.1016/j.neuroimage.2007.12.035

| **Order** | **Variable** | **Variable Description** |
| --- | --- | --- |
| 1 | idno | Participant ID |
| 2 | agebrainmri6c | Age at Exam 6 Brain MRI (years) |
| 3 | brainmri\_tt6c | Time from baseline to Exam 6 brain MRI (days) |
| 4 | fa\_qc\_code | QC Code for FA dataset:  L1 = Incidental findings, level 1  L2 = Incidental findings, level 2  L3 = Incidental findings, level 3  QC\_I\_T1\_1 = Quality control issue at image level  QC\_I\_T1\_2 = Quality control issue at image level  QC\_I\_DTI\_1 = Quality control issue at image level |
| 5 | qc\_note | MRI Reader Note explaining QC code |
| 6 | fa\_exclude | 0 = Include in analysis of FA  1 = Exclude from analysis of FA based on QC Code |
| 7 | fa\_spg\_l | Superior Parietal Gyrus Left |
| 8 | fa\_cingg\_l | Cingulate Gyrus Left |
| 9 | fa\_sfg\_l | Superior Frontal Gyrus Left |
| 10 | fa\_mfg\_l | Middle Frontal Gyrus Left |
| 11 | fa\_ifg\_l | Inferior Frontal Gyrus Left |
| 12 | fa\_prcg\_l | Precentral Gyrus Left |
| 13 | fa\_pocg\_l | Postcentral Gyrus Left |
| 14 | fa\_ag\_l | Angular Gyrus Left |
| 15 | fa\_prcu\_l | Pre-Cuneus Left |
| 16 | fa\_cu\_l | Cuneus Left |
| 17 | fa\_lg\_l | Lingual Gyrus Left |
| 18 | fa\_fu\_l | Fusiform Gyrus Left |
| 19 | fa\_phg\_l | Parahippocampal Gyrus Left |
| 20 | fa\_sog\_l | Superior Occipital Gyrus Left |
| 21 | fa\_iog\_l | Inferior Occipital Gyrus |
| 22 | fa\_mog\_l | Middle Occipital Gyrus |
| 23 | fa\_ent\_l | Entorhinal Area |
| 24 | fa\_stg\_l | Superior Temporal Gyrus |
| 25 | fa\_itg\_l | Inferior Temporal Gyrus |
| 26 | fa\_mtg\_l | Middle Temporal Gyrus |
| 27 | fa\_lfog\_l | Lateral Fronto-Orbital Gyrus |
| 28 | fa\_mfog\_l | Middle Fronto-Orbital Gyrus |
| 29 | fa\_smg\_l | Supramarginal Gyrus |
| 30 | fa\_rg\_l | Gyrus Rectus |
| 31 | fa\_ins\_l | Insular |
| 32 | fa\_amyg\_l | Amygdala |
| 33 | fa\_hippo\_l | Hippocampus |
| 34 | fa\_cerebellum\_l | Cerebellum |
| 35 | fa\_cst\_l | Corticospinal Tract Left |
| 36 | fa\_icp\_l | Inferior Cerebellar Peduncle Left |
| 37 | fa\_ml\_l | Medial Lemniscus Left |
| 38 | fa\_scp\_l | Superior Cerebellar Peduncle Left |
| 39 | fa\_cp\_l | Cerebral Peduncle Left |
| 40 | fa\_alic\_l | Anterior Limb of Internal Capsule Left |
| 41 | fa\_plic\_l | Posterior Limb of Internal Capsule Left |
| 42 | fa\_ptr\_l | Posterior Thalamic Radiation (Include Optic Radiation) Left |
| 43 | fa\_acr\_l | Anterior Corona Radiata Left |
| 44 | fa\_scr\_l | Superior Corona Radiata Left |
| 45 | fa\_pcr\_l | Posterior Corona Radiata Left |
| 46 | fa\_cgc\_l | Cingulum (Cingulate Gyrus) Left |
| 47 | fa\_cgh\_l | Cingulum (Hippocampus) Left |
| 48 | fa\_fxst\_l | Fornix (Cres) / Stria Terminalis (Can Not Be Resolved With Current Resolution) Left |
| 49 | fa\_slf\_l | Superior Longitudinal Fasciculus Left |
| 50 | fa\_sfo\_l | Superior Fronto-Occipital Fasciculus (Could Be A Part of Anterior Internal Capsule) Left |
| 51 | fa\_ifo\_l | Inferior Fronto-Occipital Fasciculus Left |
| 52 | fa\_ss\_l | Sagittal Stratum (Include Inferior Longitidinal Fasciculus And Inferior Fronto-Occipital Fasciculus) Left |
| 53 | fa\_ec\_l | External Capsule Left |
| 54 | fa\_unc\_l | Uncinate Fasciculus Left |
| 55 | fa\_pct\_l | Pontine Crossing Tract (A Part of Mcp) Left |
| 56 | fa\_mcp\_l | Middle Cerebellar Peduncle Left |
| 57 | fa\_fx\_l | Fornix (Column And Body of Fornix) Left |
| 58 | fa\_gcc\_l | Genu of Corpus Callosum Left |
| 59 | fa\_bcc\_l | Body of Corpus Callosum Left |
| 60 | fa\_scc\_l | Splenium of Corpus Callosum Left |
| 61 | fa\_rlic\_l | Retrolenticular Part of Internal Capsule Left |
| 62 | fa\_rednc\_l | Red Nucleus Left |
| 63 | fa\_snigra\_l | Substantia Nigra Left |
| 64 | fa\_tap\_l | Tapatum Left |
| 65 | fa\_caud\_l | Caudate Nucleus Left |
| 66 | fa\_put\_l | Putamen Left |
| 67 | fa\_thal\_l | Thalamus Left |
| 68 | fa\_gp\_l | Globus Pallidus Left |
| 69 | fa\_midbrain\_l | Midbrain Left |
| 70 | fa\_pons\_l | Pons Left |
| 71 | fa\_medulla\_l | Medulla Left |
| 72 | fa\_spwm\_l | Superior Parietal WM Left |
| 73 | fa\_cingwm | Cingulum WM Left |
| 74 | fa\_sfwm\_l | Superior Frontal WM Left |
| 75 | fa\_mfwm\_l | Middle Frontal WM Left |
| 76 | fa\_ifwm\_l | Inferior Frontal WM Left |
| 77 | fa\_prcwm\_l | Precentral WM Left |
| 78 | fa\_pocwm\_l | Postcentral WM Left |
| 79 | fa\_awm\_l | Angular WM Left |
| 80 | fa\_prcuwm\_l | Pre-Cuneus WM Left |
| 81 | fa\_cuwm\_l | Cuneus WM Left |
| 82 | fa\_lwm\_l | Lingual WM Left |
| 83 | fa\_fu\_wm\_l | Fusiform WM Left |
| 84 | fa\_sowm\_l | Superior Occipital WM Left |
| 85 | fa\_iowm\_l | Inferior Occipital WM Left |
| 86 | fa\_mowm\_l | Middle Occipital WM Left |
| 87 | fa\_stwm\_l | Superior Temporal WM Left |
| 88 | fa\_itwm\_l | Inferior Temporal WM Left |
| 89 | fa\_mtwm\_l | Middle Temporal WM Left |
| 90 | fa\_lfowm\_l | Lateral Fronto-Orbital WM Left |
| 91 | fa\_mfowm\_l | Middle Fronto-Orbital WM Left |
| 92 | fa\_smwm\_l | Supramarginal WM Left |
| 93 | fa\_rgwm\_l | Rectus WM Left |
| 94 | fa\_cerebellumwm\_l | Cerebellum WM Left |
| 95 | fa\_spg\_r | Superior Parietal Gyrus Right |
| 96 | fa\_cingg\_r | Cingulate Gyrus Right |
| 97 | fa\_sfg\_r | Superior Frontal Gyrus Right |
| 98 | fa\_mfg\_r | Middle Frontal Gyrus Right |
| 99 | fa\_ifg\_r | Inferior Frontal Gyrus Right |
| 100 | fa\_prcg\_r | Precentral Gyrus Right |
| 101 | fa\_pocg\_r | Postcentral Gyrus Right |
| 102 | fa\_ag\_r | Angular Gyrus Right |
| 103 | fa\_prcu\_r | Pre-Cuneus Right |
| 104 | fa\_cu\_r | Cuneus Right |
| 105 | fa\_lg\_r | Lingual Gyrus Right |
| 106 | fa\_fug\_r | Fusiform Gyrus Right |
| 107 | fa\_phg\_r | Parahippocampal Gyrus Right |
| 108 | fa\_sog\_r | Superior Occipital Gyrus Right |
| 109 | fa\_iog\_r | Inferior Occipital Gyrus Right |
| 110 | fa\_mog\_r | Middle Occipital Gyrus Right |
| 111 | fa\_ent\_r | Entorhinal Area Right |
| 112 | fa\_stg\_r | Superior Temporal Gyrus Right |
| 113 | fa\_itg\_r | Inferior Temporal Gyrus Right |
| 114 | fa\_mtg\_r | Middle Temporal Gyrus Right |
| 115 | fa\_lfog\_r | Lateral Fronto-Orbital Gyrus Right |
| 116 | fa\_mfog\_r | Middle Fronto-Orbital Gyrus Right |
| 117 | fa\_smg\_r | Supramarginal Gyrus Right |
| 118 | fa\_rg\_r | Gyrus Rectus Right |
| 119 | fa\_ins\_r | Insular Right |
| 120 | fa\_amyg\_r | Amygdala Right |
| 121 | fa\_hippo\_r | Hippocampus Right |
| 122 | fa\_cerebellum\_r | Cerebellum Right |
| 123 | fa\_cst\_r | Corticospinal Tract Right |
| 124 | fa\_icp\_r | Inferior Cerebellar Peduncle Right |
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| 133 | fa\_pcr\_r | Posterior Corona Radiata Right |
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| 142 | fa\_unc\_r | Uncinate Fasciculus Right |
| 143 | fa\_pct\_r | Pontine Crossing Tract (A Part of MCP) Right |
| 144 | fa\_mcp\_r | Middle Cerebellar Peduncle Right |
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| 149 | fa\_rlic\_r | Retrolenticular Part of Internal Capsule Right |
| 150 | fa\_rednc\_r | Red Nucleus Right |
| 151 | fa\_snigra\_r | Substantia Nigra Right |
| 152 | fa\_tap\_r | Tapatum Right |
| 153 | fa\_caud\_r | Caudate Nucleus Right |
| 154 | fa\_put\_r | Putamen Right |
| 155 | fa\_thal\_r | Thalamus Right |
| 156 | fa\_gp\_r | Globus Pallidus Right |
| 157 | fa\_midbrain\_r | Midbrain Right |
| 158 | fa\_pons\_r | Pons Right |
| 159 | fa\_medulla\_r | Medulla Right |
| 160 | fa\_spwm\_r | Superior Parietal WM Right |
| 161 | fa\_cingwm\_r | Cingulum WM Right |
| 162 | fa\_sfwm\_r | Superior Frontal WM Right |
| 163 | fa\_mfwm\_r | Middle Frontal WM Right |
| 164 | fa\_ifwm\_r | Inferior Frontal WM Right |
| 165 | fa\_prcwm\_r | Precentral WM Right |
| 166 | fa\_pocwm\_r | Postcentral WM Right |
| 167 | fa\_awm\_r | Angular WM Right |
| 168 | fa\_prcuwm\_r | Pre-Cuneus WM Right |
| 169 | fa\_cuwm\_r | Cuneus WM Right |
| 170 | fa\_lwm\_r | Lingual WM Right |
| 171 | fa\_fuwm\_r | Fusiform WM Right |
| 172 | fa\_sowm\_r | Superior Occipital WM Right |
| 173 | fa\_iowm\_r | Inferior Occipital WM Right |
| 174 | fa\_mowm\_r | Middle Occipital WM Right |
| 175 | fa\_stwm\_r | Superior Temporal WM Right |
| 176 | fa\_itwm\_r | Inferior Temporal WM Right |
| 177 | fa\_mtwm\_r | Middle Temporal WM Right |
| 178 | fa\_lfowm\_r | Lateral Fronto-Orbital WM Right |
| 179 | fa\_mfowm\_r | Middle Fronto-Orbital WM Right |
| 180 | fa\_smwm\_r | Supramarginal WM Right |
| 181 | fa\_rgwm\_r | Rectus WM Right |
| 182 | fa\_cerebellumwm\_r | Cerebellum WM Right |
| 183 | bmri\_fa\_eve\_exam | Exam of ancillary AS253 brain MRI |