Hearing loss meta-analysis

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Methods

Eligibility Criteria

We included peer-review publications in English, involving patients with bilateral congenital and mixed hearing loss and controls with structural Magnetic Resonance Imaging.
Study design was using cross-sectional including control groups, ivestigating the structural relation between MRI changes and the Hearing loss. ROI were selected among the included studies Analysis method, the most common outcome measures were **volume, FA, VBM and thickness.** A total of 41 studies were included, with a total of 851 patients and 964 patients.
Notes:

1. I excluded Xia et al. Chin J Rad, 2008 because I don't understand chinese and it appears to be the same data as Xia et al. Chin J Med Img Tech, 2008
2. Kim et al. Hear Res 2014 used two groups prelingual deaf and post lingual deaf, I used the average for the main table.
3. Xia et al. Chin J Med Img Tech, 2008 had a total of 40 patients, two groups 9-12 years and 19-22 years, no controls
4. Zheng et al. Sci Rep, 2017 this variables change; Con rangeLow Con rangeHigh. Why? I didn't find them on the orignal paper

Effect size direction was directly include in the Cohen's D value by mutipliying by -1 if the effect was decrease and by 1 if it was none of increased. Forests plots were calculated the meta-regression for left and right. We measure a global meta regression for white and gray mater by side (Left and rigth). We include those ROI with most frequency of apearing.

Effects were summarized across studies using the generic inverse-variance weighting method with DerSimonian and Laird random effects, meaning studies were weighted by $1/SE$š (where SE is the standard error)

$$Hedges'G = \frac{X_1 - X_2}{\sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}}$$

Assumptions:

1. We assume that the calculation of the cohen's D is correct.
2. We assume that the direction of the effect is correct.
3. Variance was estimated using the cohen's D and sample size of each study. Our estimated variance was used for all meta-regressions, therefore we could have and additional in the between studies variance and eterogeneity calculations. We should have done the mean and standart deviation from each study. Variance was estimated using the following formula:

$$Variance = \frac{n1 + n2}{n1 \times n2} + \frac{Hedges'G^2}{2 \times (n1 + n2 - 2)}$$

Estimate of heterogeneity per model

"We estimated heterogeneity in results using the τ statistic, which represents the standard deviation" such as overall.hetstat or a heterogeneity test $x2$ and $I2$ index
We performed a multi-level meta-analytic model, over our multiple effect size estimates nested withing variables: Big brain area, ROI, etc. We expect that the underlying true effects are more similar for the same level of the grouping variable than thrue effects arising from different levels
"We can account for the correlation in the true effects by adding a random effect to the model at the level corresponding to the grouping variable." The dataset contains the result from N studies, each comparing different measurements between patients and controls. The diference of between groups was quantified in terms of Cohen's D.

Notes from Francis

Remember I created the effect size because are the variables and metric were different. This take mean and SD out of the equation. But you can represent the mean and SD as another variable if you want to calculate what effect sizes would create a cohen's d and cc r for specific variables. That way we would standardize it across our different means and SD. 2.1.16. CC which is the correlation coefficient
2.3. Calculate Hedges' g which takes into consideration sample size
> I used Cohen's D instead of these last two because ai calculated the variace from the cohen's D, but I can do it for the Hedges'G as well

Table 1: Total included studies: 41

	Hearing Loss	Healthy
Total number of patients	2778	4214
Number mean	47.08	71.42
Number sd	128.5	250.6
Age mean	33.07	30.96
Age SD	22.66	20.5
%Female mean	50.02	55.71
%Female sd	12.05	12.78

Table of included studies

Table 2: Studies with incomplete information (NA)

	Source	MRI Tesla	all.techniques	all.measures
5	2006, Kara et al. J Neuroradiol	1.5	VBM	length, Thickness, volume
9	2008, Xia et al. Chin J Med Img Tech	1.5	VBM	volume
12	2010, Husain et al. Brain Res	3	DTI, VBM	FA, volume
26	2014, Lyness et al. Neuroimage	1.5	DTI	FA, MD, RD
41	2017, Karns et al. Hear Res	3	DTI	AD, FA, RD, volume
48	2018, Kumar U, Mishra M. Brain Res	3	VBM	Thickness, VBM

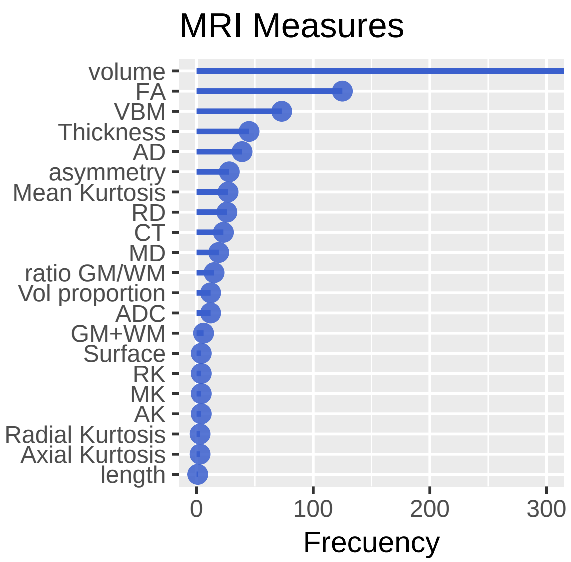
Table 3: Included studies

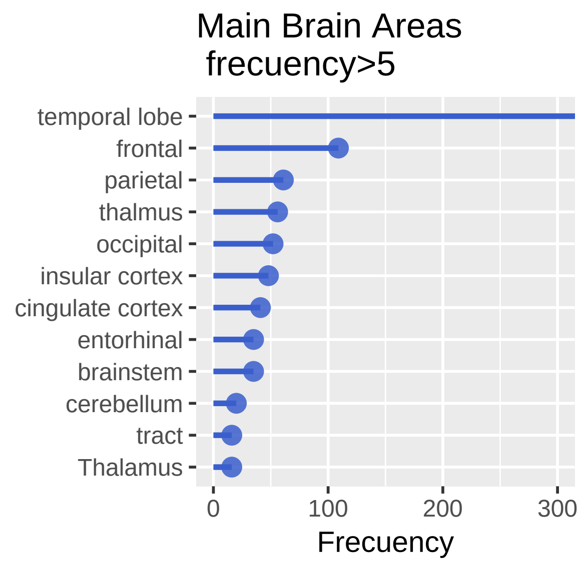
	Source	MRI Tesla	all.techniques	all.measures
1	2000, Bavelier et al. J Neurosci	1.5	VBM	volume
2	2003, Emmorey et al. PNAS	1.5	VBM	asymmetry, GM+WM, ratio GM/WM, volume
3	2003, Penhune et al. Neuroimage	1.5	VBM	asymmetry, ratio GM/WM, volume
4	2004, Chang et al. Neuroreport	3	DTI	asymmetry, FA

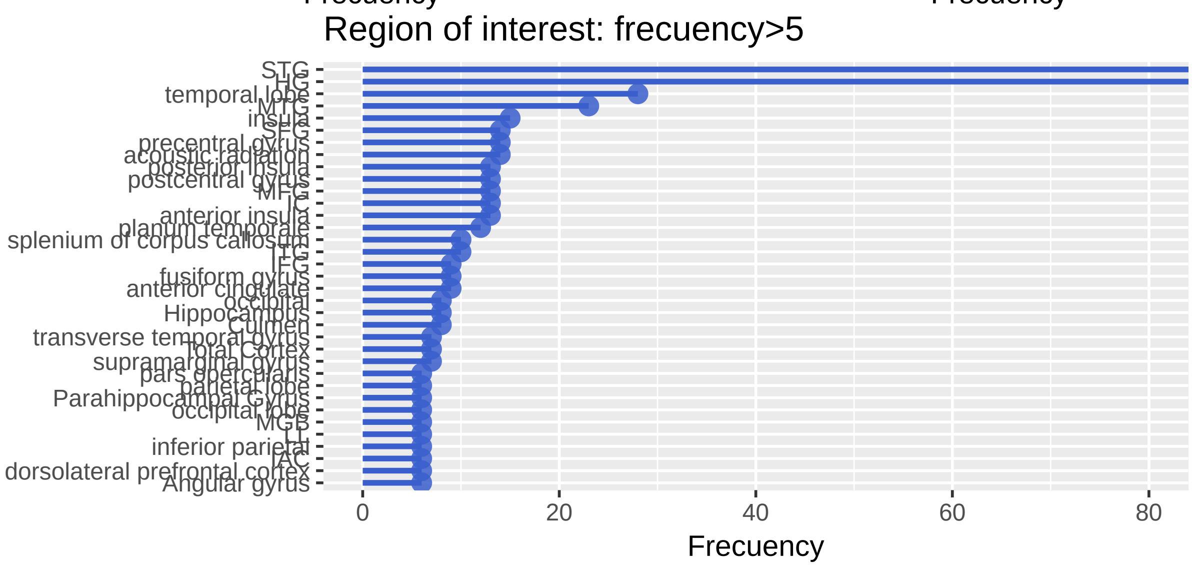
	Source	MRI Tesla	all.techniques	all.measures
6	2007, Meyer et al. Restor Neurol Neurosci	3	VBM	volume
7	2007, Shibata DK. Am J Neuroradiol	1.5	VBM	volume
8	2008, Allen et al. J Neurosci	1.5	VBM	asymmetry, ratio GM/WM, Vol proportion, volume
10	2009, Kim et al. Neuroreport	3	DTI, VBM	FA, volume
11	2009, Wang et al. Chin J Med Img Tech	3	DTI	FA
13	2010, Leporé et al. Hum Brain Mapp	1.5	VBM	VBM
14	2010, Li, et al. J Clin Rad	1.5	VBM	volume
15	2010, Liu et al. Chin J Med Img Tech	3	CT	FA
16	2011, Smith et al. Cereb Cortex	3	VBM	asymmetry, ratio GM/WM, volume
17	2012, Li et al. Brain Res	3	CT	Thickness
18	2012, Li et al. Hum Brain Mapp	3	DTI	AD, FA, RD
19	2013, Allen et al. Front Neuroanat	1.5	VBM	asymmetry, volume
20	2013, Boyen et al. Hear Res	3	VBM	volume
21	2013, Miao et al. Am J Neuroradiol	3	DTI	FA, RD
22	2013, Pénicaud et al. Neuroimage	1.5	VBM	volume
23	2014, Hribar et al. Hear Res	3	DTI, VBM	AD, FA, Thickness
24	2014, Kim et al. Hear Res	3	VBM	volume
25	2014, Lin et al. Neuroimage	1.5	VBM	volume
27	2014, Olulade et al. J Neurosci	3	VBM	volume
28	2014, Profant et al. Neuroscience	3	DTI, VBM	AD, CT, FA, MD, RD, Surface, volume
29	2014, Profant et al. Neuroscience	3	DTI, VBM	AD, CT, FA, MD, RD, Surface, volume
30	2015, Huang et al. PLoS One	1.5	DTI	FA, MD
31	2015, Tae Investig Magn Reson Imaging	1.5	VBM	VBM
32	2016, Amaral et al. Eur J Neurosci	3	VBM	asymmetry, Thickness
33	2016, Chinnadurai et al. Magn Reson Imaging	1.5	DTI	AD, Axial Kurtosis, FA, Mean Kurtosis, Radial Kurtosis, RD
34	2016, Ma et al. AJNR Am J Neuroradiol	3	DTI	AD, FA, MD, RD
35	2016, Shiell et al. Neural Plasticity	3	CT	Thickness
36	2016, Shi et al. Neuroreport	3	VBM	volume
37	2016, Smittenaar et al. Open Neuroimag J	1.5	CT	CT
38	2016, Wu et al. Brain Res	1.5	VBM	ADC, FA
39	2016, Wu et al. Brain Res	1.5	VBM	ADC, FA
40	2016, Wu et al. Brain Res	1.5	VBM	ADC, FA
42	2017, Kim et al. Neuroreport	3	DTI	FA
43	2017, Shiell & Zatorre. Hear Res	3	DTI	AD, MD, RD, volume
44	2017, Zheng et al. Sci Rep	3	DTI	FA, Mean Kurtosis
45	2018, Benetti et al. Neuroimage	4	DTI	AD, FA, RD
46	2018, Chen et al. Behav Neurosci	3	VBM	volume
47	2018, Feng et al. PNAS	3	VBM	VBM
49	2018, Park et al. Biomed Res Int	3	DTI	FA
50	2018, Pereira-Jorge et al. Neural Plast	1.5	VBM	volume
51	2018, Ren et al. Front Neurosci	3	CT, VBM	Thickness, volume
52	2018, Uchida et al. Front Aging Neurosci	3	VBM	volume
53	2018, Uchida et al. Front Aging Neurosci	3	VBM	volume
54	2018, Zou et al. Otol Neurotol	3	DTI	AK, FA, MK, RK
55	2019, Belkhiria et al. Front. Aging Neurosci	3	VBM	CT, volume
56	2019, Belkhiria et al. Front. Aging Neurosci	3	VBM	CT, volume
57	2019, Luan et al. Front Neurosci	3	DTI, VBM	FA, MD, volume
58	2019, Ponticorvo et al. Hum Brain Mapp	3	VBM	volume

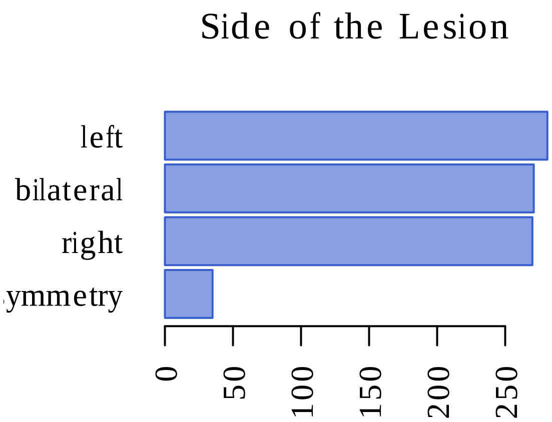
	Source	MRI Tesla	all.techniques	all.measures
59	2019, Xu et al. J Magn Reson Imaging	3	VBM	volume

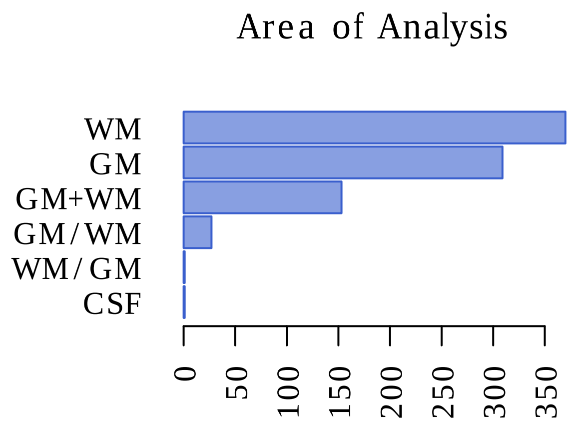
Overal view of the studies



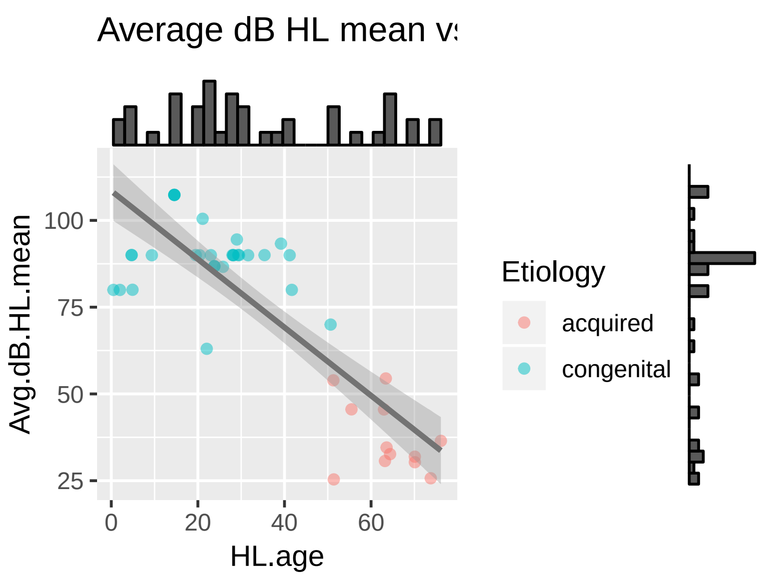








Relation of Average dB and Age



Frequency and contingensy tables

a. Most of the studies that measured Gray matter focus on cortical changes (volume, thicknes and VBM).

b. White matter studies are more heterogeneous in their measurements.

c. Diffusion tensor (DT) derived mesurements are the most frequent in white matter, followed by volume. c.1 It is harder to interpret a meta-analysis of multiple white matter measurements because their effect varies widely and in different directions. The measurements derived from DT have the most differences.

WE conduct our meta-analysis using the **TWO** most frequent measurements for gray and white matter. We use *volume* for GM and *fractional anysotropy* for WM.

Further meta regressions can be found in the supplementary material.
Gray Matter
- thickness
- VBM

White Matter integrity
- mean diffusivity MD
- radial diffusivity RD
- axial diffusivity AD
- mean kurtosis

White Matter volume
- thickness (I am unsure how they did this)
- VBM
- volume

Frequency tables: measures of WM & GM

Table 4: Matter vs Side

	asymmetry	bilateral	left	right	total
GM	9	59	130	109	2
WM	15	164	93	97	1

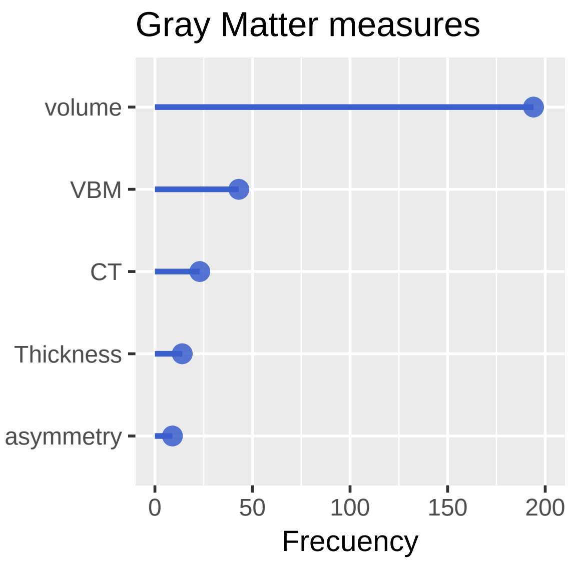
Table 5: Matter vs measure (continued below)

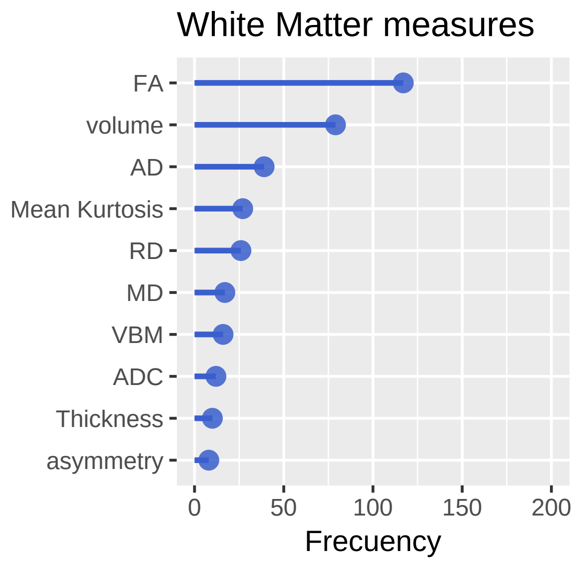
	AD	ADC	AK	asymmetry	Axial Kurtosis	CT	FA	GM+WM
GM	0	0	2	9	0	23	8	0
WM	39	12	2	8	3	0	117	0

Table 6: Table continues below

	length	MD	Mean Kurtosis	MK	Radial Kurtosis	ratio GM/WM	RD
GM	0	2	0	2	0	0	0
WM	1	17	27	2	3	0	26

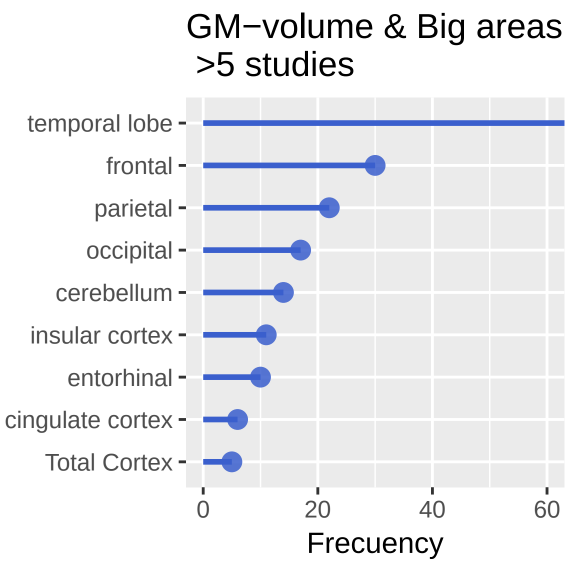
	RK	Surface	Thickness	VBM	Vol proportion	volume
GM	2	4	14	43	6	194
WM	2	0	10	16	6	79

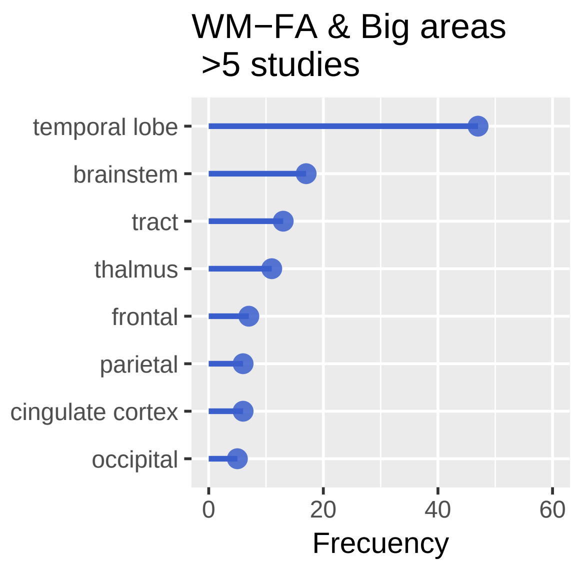




Contingensy tables: Main areas and sub-areas

Sub-analys were carried out in those areas that had measures from at least five studies. Those areas were selected from the contingensy tables.





Most common ROI for WM-FA and GM-volume

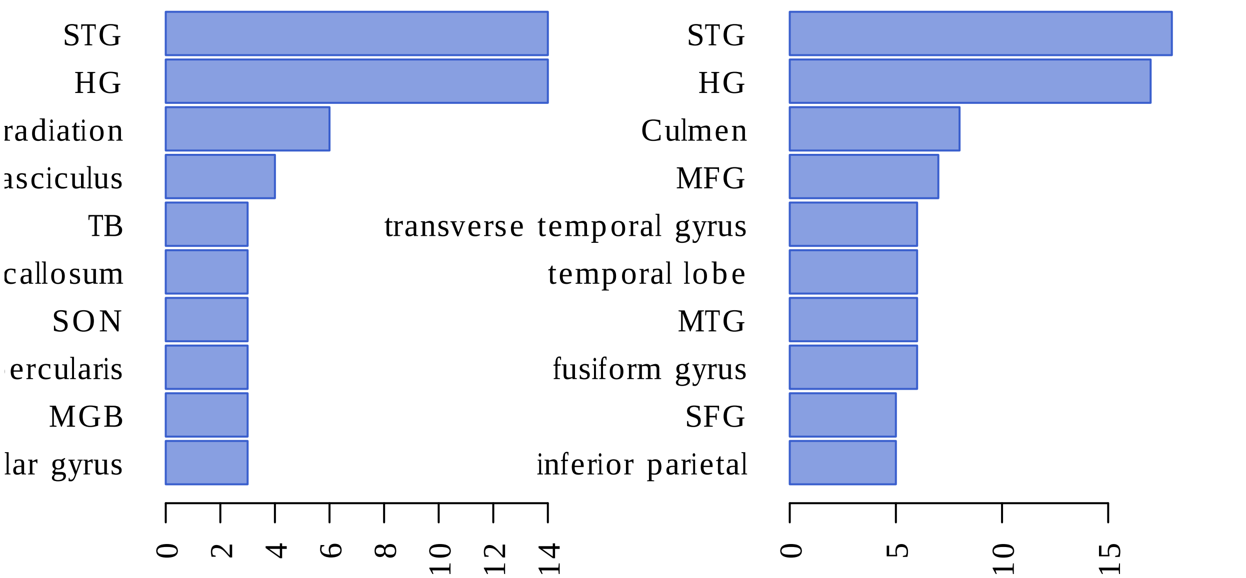
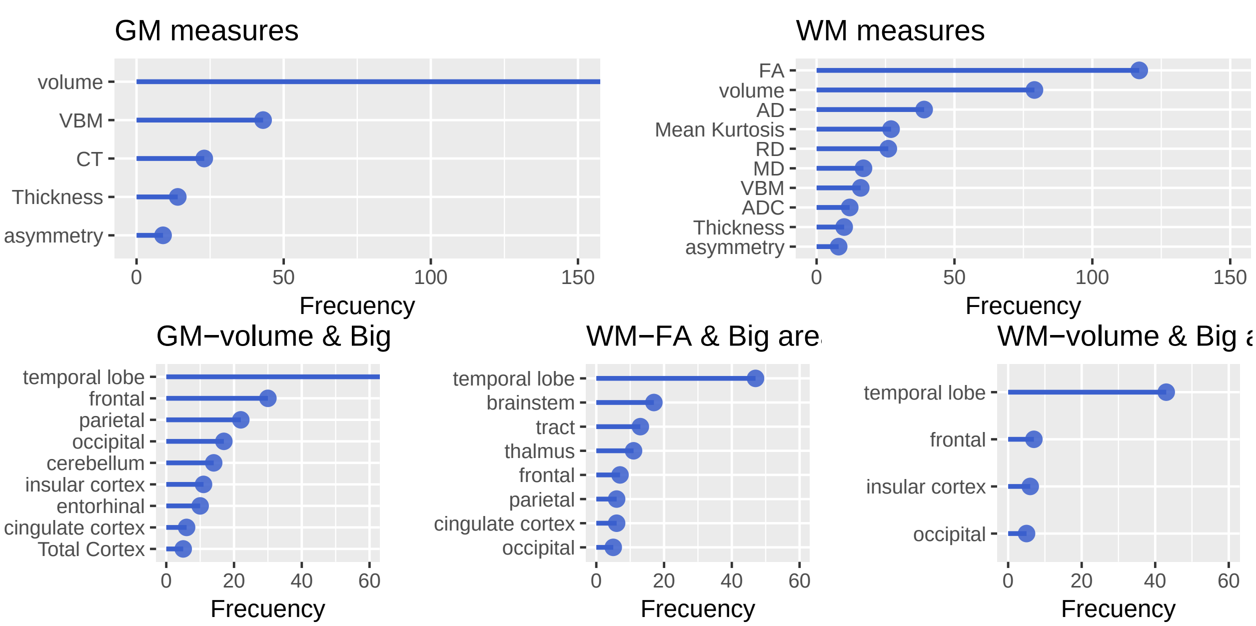
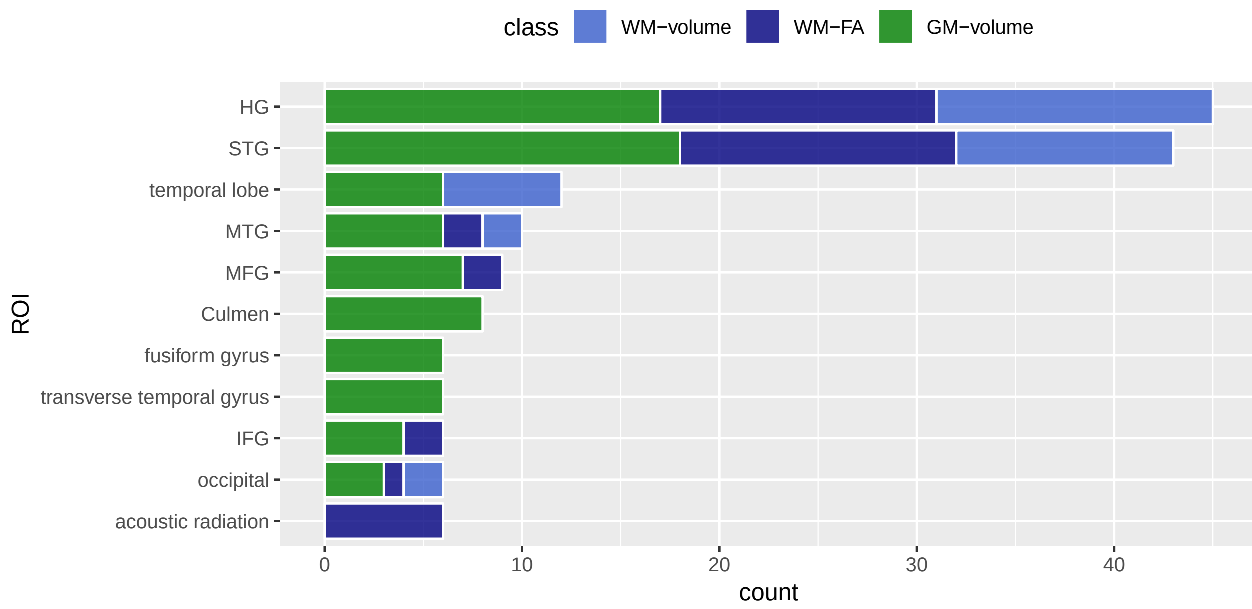
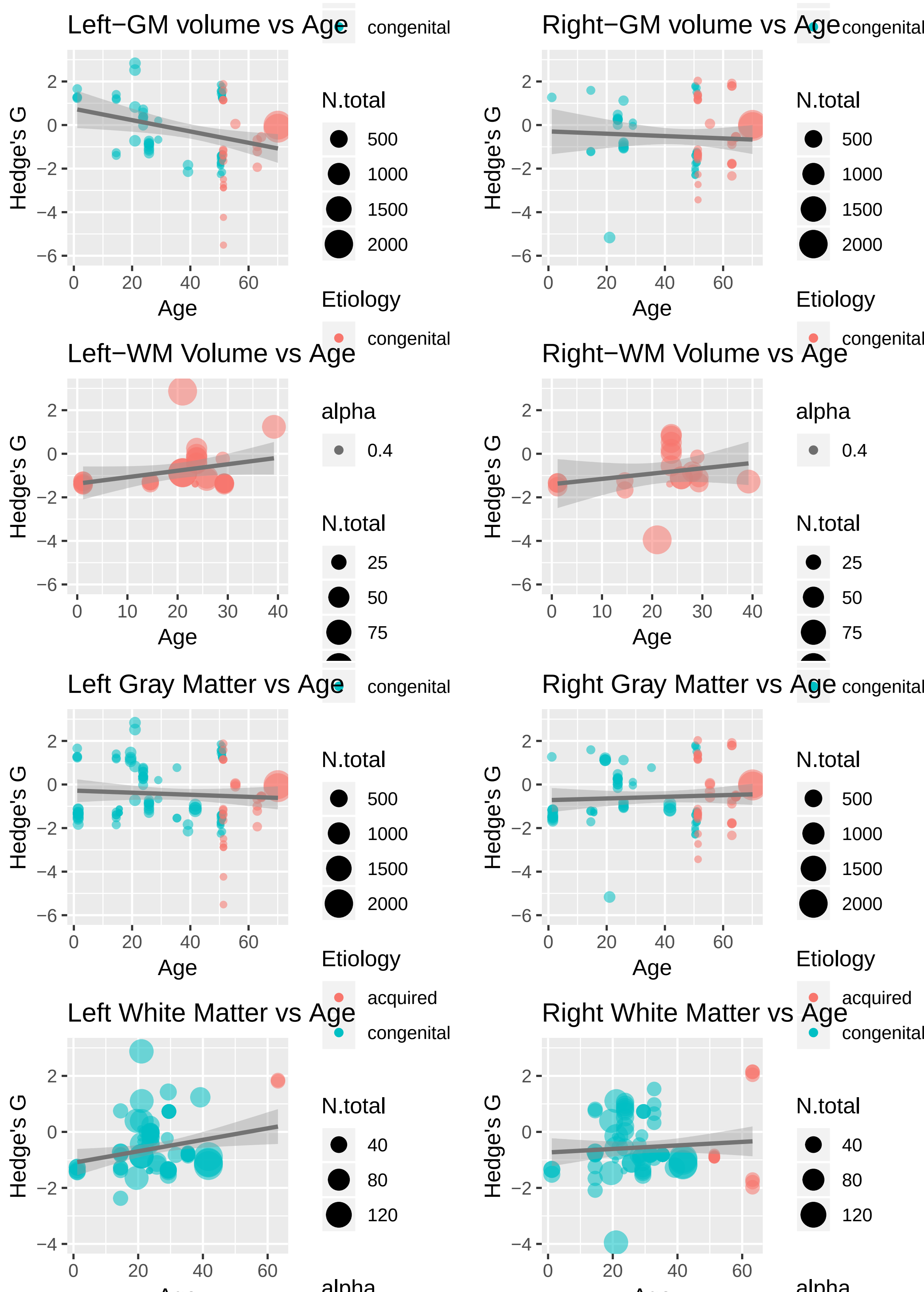


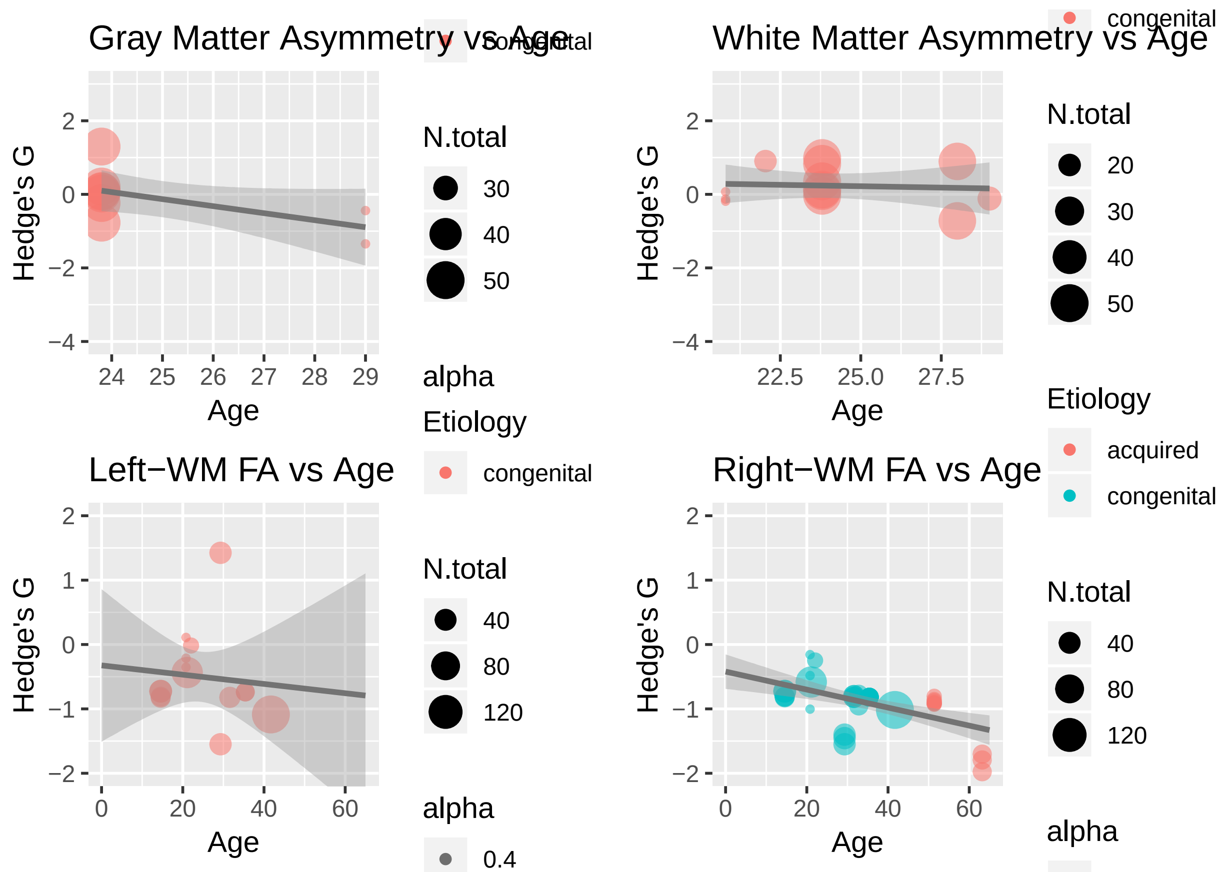
Figure 1 - Methods: Distribution of data by Gray/white matter and measure




class
WM−volume
WM−FA
GM−volume
ROI
HG
STG
temporal lobe
MTG
MFG
Culmen
fusiform gyrus
transverse temporal gyrus
IFG
occipital
acoustic radiation
0
10
20
30
40
count

Gray and White matter relation with Age





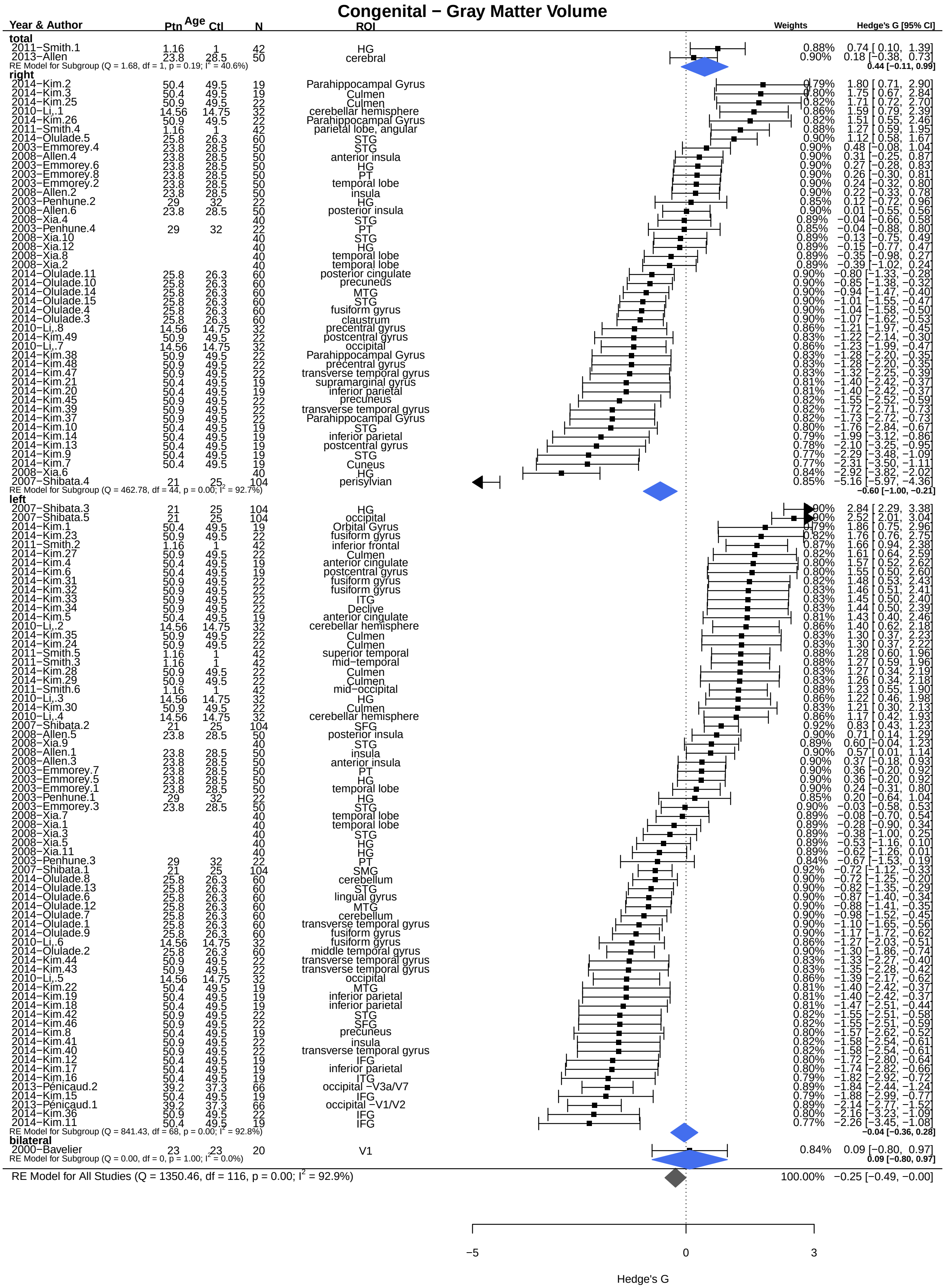
CONGENITAL - Meta-regressions of Gray Matter by Volume

Gray Matter Volume: Random effects model no intercept covariated by Big area

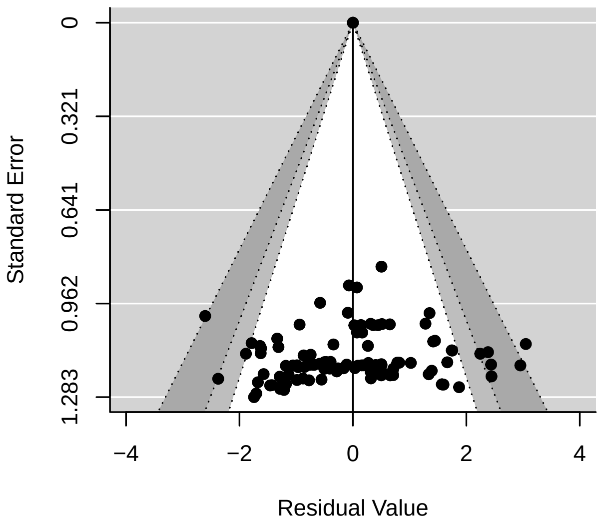
Table 8: Table continues below

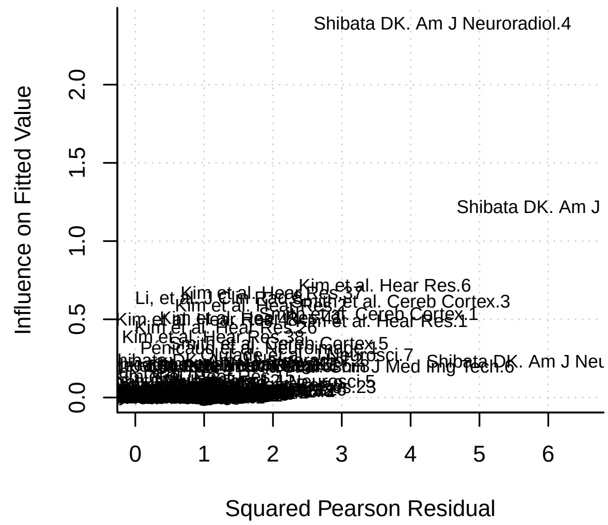
	HedgeG	se	zval	ci.lo	ci.up
left cerebellum	0.9013	0.3735	2.413	0.1693	1.633
left cingulate	1.5	0.9037	1.66	-0.2712	3.271
left frontal	-0.588	0.4468	-1.316	-1.464	0.2877
left insular cortex	0.0628	0.6065	0.1035	-1.126	1.252
left occipital	-0.5252	0.4567	-1.15	-1.42	0.3699
left parietal	-0.8875	0.5149	-1.724	-1.897	0.1217
left temporal lobe	-0.116	0.2235	-0.5189	-0.554	0.3221
left thalmus	1.282	1.213	1.056	-1.097	3.66
right cerebellum	1.682	0.7284	2.309	0.254	3.109
right cingulate cortex	-0.8018	1.193	-0.6721	-3.14	1.536
right entorhinal	0.05865	0.6339	0.09251	-1.184	1.301
right frontal	-2.559	0.7143	-3.583	-3.959	-1.159
right insular cortex	-0.1339	0.598	-0.2239	-1.306	1.038
right occipital	-1.73	0.8957	-1.932	-3.486	0.02545
right parietal	-1.113	0.4445	-2.503	-1.984	-0.2413
right temporal lobe	-0.5427	0.2729	-1.989	-1.078	-0.007815

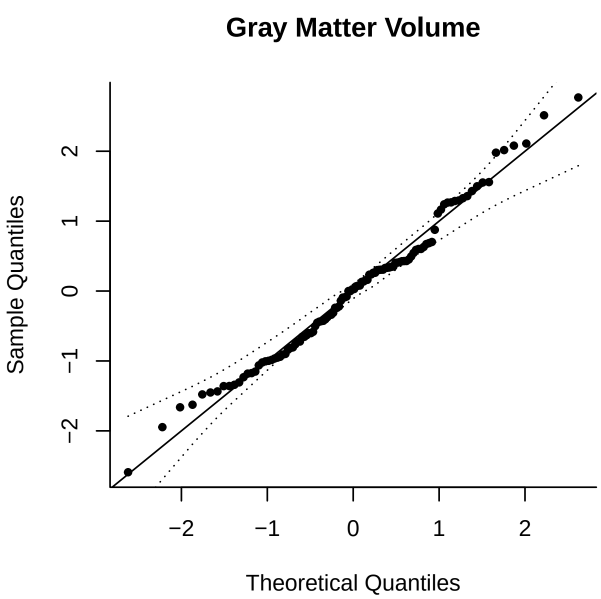
	pval
left cerebellum	0.01581
left cingulate	0.09694
left frontal	0.1882
left insular cortex	0.9175
left occipital	0.2502
left parietal	0.08478
left temporal lobe	0.6039
left thalmus	0.2909
right cerebellum	0.02096
right cingulate cortex	0.5015
right entorhinal	0.9263
right frontal	0.0003399
right insular cortex	0.8228
right occipital	0.05341
right parietal	0.01233
right temporal lobe	0.04675



Congenital − Gray Matter Volume
Year & Author | Age Ptn | Ctl | N | ROI | Weights | Hedge's G [95% CI]
total
2011−Smith.1 1.16 1 42 HG 0.88% 0.74 [0.10, 1.39]
2013−Allen 23.8 28.5 50 cerebral 0.90% 0.18 [−0.38, 0.73]
RE Model for Subgroup (Q = 1.68, df = 1, p = 0.19; I² = 40.6%) 0.44 [−0.11, 0.99]
right
2014−Kim.2 50.4 49.5 19 Parahippocampal Gyrus 0.79% 1.80 [0.71, 2.90]
2014−Kim.3 50.4 49.5 19 Culmen 0.80% 1.75 [0.67, 2.84]
2014−Kim.25 50.9 49.5 22 Culmen 0.82% 1.71 [0.72, 2.70]
2010−Li,.1 14.56 14.75 32 cerebellar hemisphere 0.86% 1.59 [0.79, 2.39]
2014−Kim.26 50.9 49.5 22 Parahippocampal Gyrus 0.82% 1.51 [0.55, 2.46]
2011−Smith.4 1.16 1 42 parietal lobe, angular 0.88% 1.27 [0.59, 1.95]
2014−Olulade.5 25.8 26.3 60 STG 0.90% 1.12 [0.58, 1.67]
2003−Emmorey.4 23.8 28.5 50 STG 0.90% 0.48 [−0.08, 1.04]
2008−Allen.4 23.8 28.5 50 anterior insula 0.90% 0.31 [−0.25, 0.87]
2003−Emmorey.6 23.8 28.5 50 HG 0.90% 0.27 [−0.28, 0.83]
2003−Emmorey.8 23.8 28.5 50 PT 0.90% 0.26 [−0.30, 0.81]
2003−Emmorey.2 23.8 28.5 50 temporal lobe 0.90% 0.24 [−0.32, 0.80]
2008−Allen.2 23.8 28.5 50 insula 0.90% 0.22 [−0.33, 0.78]
2003−Penhune.2 29 32 22 HG 0.85% 0.12 [−0.72, 0.96]
2008−Allen.6 23.8 28.5 50 posterior insula 0.90% 0.01 [−0.55, 0.56]
2008−Xia.4 40 STG 0.89% −0.04 [−0.66, 0.58]
2003−Penhune.4 29 32 22 PT 0.85% −0.04 [−0.88, 0.80]
2008−Xia.10 40 STG 0.89% −0.13 [−0.75, 0.49]
2008−Xia.12 40 HG 0.89% −0.15 [−0.77, 0.47]
2008−Xia.8 40 temporal lobe 0.89% −0.35 [−0.98, 0.27]
2008−Xia.2 40 temporal lobe 0.89% −0.39 [−1.02, 0.24]
2014−Olulade.11 25.8 26.3 60 posterior cingulate 0.90% −0.80 [−1.33, −0.28]
2014−Olulade.10 25.8 26.3 60 precuneus 0.90% −0.85 [−1.38, −0.32]
2014−Olulade.14 25.8 26.3 60 MTG 0.90% −0.94 [−1.47, −0.40]
2014−Olulade.15 25.8 26.3 60 STG 0.90% −1.01 [−1.55, −0.47]
2014−Olulade.4 25.8 26.3 60 fusiform gyrus 0.90% −1.04 [−1.58, −0.50]
2014−Olulade.3 25.8 26.3 60 claustrum 0.90% −1.07 [−1.62, −0.53]
2010−Li,.8 14.56 14.75 32 precentral gyrus 0.86% −1.21 [−1.97, −0.45]
2014−Kim.49 50.9 49.5 22 postcentral gyrus 0.83% −1.22 [−2.14, −0.30]
2010−Li,.7 14.56 14.75 32 occipital 0.86% −1.23 [−1.99, −0.47]
2014−Kim.38 50.9 49.5 22 Parahippocampal Gyrus 0.83% −1.28 [−2.20, −0.35]
2014−Kim.48 50.9 49.5 22 precentral gyrus 0.83% −1.28 [−2.20, −0.35]
2014−Kim.47 50.9 49.5 22 transverse temporal gyrus 0.83% −1.32 [−2.25, −0.39]
2014−Kim.21 50.4 49.5 19 supramarginal gyrus 0.81% −1.40 [−2.42, −0.37]
2014−Kim.20 50.4 49.5 19 inferior parietal 0.81% −1.40 [−2.42, −0.37]
2014−Kim.45 50.9 49.5 22 precuneus 0.82% −1.55 [−2.52, −0.59]
2014−Kim.39 50.9 49.5 22 transverse temporal gyrus 0.82% −1.72 [−2.71, −0.73]
2014−Kim.37 50.9 49.5 22 Parahippocampal Gyrus 0.82% −1.73 [−2.72, −0.73]
2014−Kim.10 50.4 49.5 19 STG 0.80% −1.76 [−2.84, −0.67]
2014−Kim.14 50.4 49.5 19 inferior parietal 0.79% −1.99 [−3.12, −0.86]
2014−Kim.13 50.4 49.5 19 postcentral gyrus 0.78% −2.10 [−3.25, −0.95]
2014−Kim.9 50.4 49.5 19 STG 0.77% −2.29 [−3.48, −1.09]
2014−Kim.7 50.4 49.5 19 Cuneus 0.77% −2.31 [−3.50, −1.11]
2008−Xia.6 40 HG 0.84% −2.92 [−3.82, −2.02]
2007−Shibata.4 21 25 104 perisylvian 0.85% −5.16 [−5.97, −4.36]
RE Model for Subgroup (Q = 462.78, df = 44, p = 0.00; I² = 92.7%) −0.60 [−1.00, −0.21]
left
2007−Shibata.3 21 25 104 HG 0.90% 2.84 [2.29, 3.38]
2007−Shibata.5 21 25 104 occipital 0.90% 2.52 [2.01, 3.04]
2014−Kim.1 50.4 49.5 19 Orbital Gyrus 0.79% 1.86 [0.75, 2.96]
2014−Kim.23 50.9 49.5 22 fusiform gyrus 0.82% 1.76 [0.76, 2.75]
2011−Smith.2 1.16 1 42 inferior frontal 0.87% 1.66 [0.94, 2.38]
2014−Kim.27 50.9 49.5 22 Culmen 0.82% 1.61 [0.64, 2.59]
2014−Kim.4 50.4 49.5 19 anterior cingulate 0.80% 1.57 [0.52, 2.62]
2014−Kim.6 50.4 49.5 19 postcentral gyrus 0.80% 1.55 [0.50, 2.60]
2014−Kim.31 50.9 49.5 22 fusiform gyrus 0.82% 1.48 [0.53, 2.43]
2014−Kim.32 50.9 49.5 22 fusiform gyrus 0.83% 1.46 [0.51, 2.41]
2014−Kim.33 50.9 49.5 22 ITG 0.83% 1.45 [0.50, 2.40]
2014−Kim.34 50.9 49.5 22 Declive 0.83% 1.44 [0.50, 2.39]
2014−Kim.5 50.4 49.5 19 anterior cingulate 0.81% 1.43 [0.40, 2.46]
2010−Li,.2 14.56 14.75 32 cerebellar hemisphere 0.86% 1.40 [0.62, 2.18]
2014−Kim.35 50.9 49.5 22 Culmen 0.83% 1.30 [0.37, 2.23]
2014−Kim.24 50.9 49.5 22 Culmen 0.83% 1.30 [0.37, 2.22]
2011−Smith.5 1.16 1 42 superior temporal 0.88% 1.28 [0.60, 1.96]
2011−Smith.3 1.16 1 42 mid−temporal 0.88% 1.27 [0.59, 1.96]
2014−Kim.28 50.9 49.5 22 Culmen 0.83% 1.27 [0.34, 2.19]
2014−Kim.29 50.9 49.5 22 Culmen 0.83% 1.26 [0.34, 2.18]
2011−Smith.6 1.16 1 42 mid−occipital 0.88% 1.23 [0.55, 1.90]
2010−Li,.3 14.56 14.75 32 HG 0.86% 1.22 [0.46, 1.98]
2014−Kim.30 50.9 49.5 22 Culmen 0.83% 1.21 [0.30, 2.13]
2010−Li,.4 14.56 14.75 32 cerebellar hemisphere 0.86% 1.17 [0.42, 1.93]
2007−Shibata.2 21 25 104 SFG 0.92% 0.83 [0.43, 1.23]
2008−Allen.5 23.8 28.5 50 posterior insula 0.90% 0.71 [0.14, 1.29]
2008−Xia.9 40 STG 0.89% 0.60 [−0.04, 1.23]
2008−Allen.1 23.8 28.5 50 insula 0.90% 0.57 [0.01, 1.14]
2008−Allen.3 23.8 28.5 50 anterior insula 0.90% 0.37 [−0.18, 0.93]
2003−Emmorey.7 23.8 28.5 50 PT 0.90% 0.36 [−0.20, 0.92]
2003−Emmorey.5 23.8 28.5 50 HG 0.90% 0.36 [−0.20, 0.92]
2003−Emmorey.1 23.8 28.5 50 temporal lobe 0.90% 0.24 [−0.31, 0.80]
2003−Penhune.1 29 32 22 HG 0.85% 0.20 [−0.64, 1.04]
2003−Emmorey.3 23.8 28.5 50 STG 0.90% −0.03 [−0.58, 0.53]
2008−Xia.7 40 temporal lobe 0.89% −0.08 [−0.70, 0.54]
2008−Xia.1 40 temporal lobe 0.89% −0.28 [−0.90, 0.34]
2008−Xia.3 40 STG 0.89% −0.38 [−1.00, 0.25]
2008−Xia.5 40 HG 0.89% −0.53 [−1.16, 0.10]
2008−Xia.11 40 HG 0.89% −0.62 [−1.26, 0.01]
2003−Penhune.3 29 32 22 PT 0.84% −0.67 [−1.53, 0.19]
2007−Shibata.1 21 25 104 SMG 0.92% −0.72 [−1.12, −0.33]
2014−Olulade.8 25.8 26.3 60 cerebellum 0.90% −0.72 [−1.25, −0.20]
2014−Olulade.13 25.8 26.3 60 STG 0.90% −0.82 [−1.35, −0.29]
2014−Olulade.6 25.8 26.3 60 lingual gyrus 0.90% −0.87 [−1.40, −0.34]
2014−Olulade.12 25.8 26.3 60 MTG 0.90% −0.88 [−1.41, −0.35]
2014−Olulade.7 25.8 26.3 60 cerebellum 0.90% −0.98 [−1.52, −0.45]
2014−Olulade.1 25.8 26.3 60 transverse temporal gyrus 0.90% −1.10 [−1.65, −0.56]
2014−Olulade.9 25.8 26.3 60 fusiform gyrus 0.90% −1.17 [−1.72, −0.62]
2010−Li,.6 14.56 14.75 32 fusiform gyrus 0.86% −1.27 [−2.03, −0.51]
2014−Olulade.2 25.8 26.3 60 middle temporal gyrus 0.90% −1.30 [−1.86, −0.74]
2014−Kim.44 50.9 49.5 22 transverse temporal gyrus 0.83% −1.33 [−2.27, −0.40]
2014−Kim.43 50.9 49.5 22 transverse temporal gyrus 0.83% −1.35 [−2.28, −0.42]
2010−Li,.5 14.56 14.75 32 occipital 0.86% −1.39 [−2.17, −0.62]
2014−Kim.22 50.4 49.5 19 MTG 0.81% −1.40 [−2.42, −0.37]
2014−Kim.19 50.4 49.5 19 inferior parietal 0.81% −1.40 [−2.42, −0.37]
2014−Kim.18 50.4 49.5 19 inferior parietal 0.81% −1.47 [−2.51, −0.44]
2014−Kim.42 50.9 49.5 22 STG 0.82% −1.55 [−2.51, −0.58]
2014−Kim.46 50.9 49.5 22 SFG 0.82% −1.55 [−2.51, −0.59]
2014−Kim.8 50.4 49.5 19 precuneus 0.80% −1.57 [−2.62, −0.52]
2014−Kim.41 50.9 49.5 22 insula 0.82% −1.58 [−2.54, −0.61]
2014−Kim.40 50.9 49.5 22 transverse temporal gyrus 0.82% −1.58 [−2.54, −0.61]
2014−Kim.12 50.4 49.5 19 IFG 0.80% −1.72 [−2.80, −0.64]
2014−Kim.17 50.4 49.5 19 inferior parietal 0.80% −1.74 [−2.82, −0.66]
2014−Kim.16 50.4 49.5 19 ITG 0.79% −1.82 [−2.92, −0.72]
2013−Pénicaud.2 39.2 37.3 66 occipital −V3a/V7 0.89% −1.84 [−2.44, −1.24]
2014−Kim.15 50.4 49.5 19 IFG 0.79% −1.88 [−2.99, −0.77]
2013−Pénicaud.1 39.2 37.3 66 occipital −V1/V2 0.89% −2.14 [−2.77, −1.52]
2014−Kim.36 50.9 49.5 22 IFG 0.80% −2.16 [−3.23, −1.09]
2014−Kim.11 50.4 49.5 19 IFG 0.77% −2.26 [−3.45, −1.08]
RE Model for Subgroup (Q = 841.43, df = 68, p = 0.00; I² = 92.8%) −0.04 [−0.36, 0.28]
bilateral
2000−Bavelier 23 23 20 V1 0.84% 0.09 [−0.80, 0.97]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) 0.09 [−0.80, 0.97]
RE Model for All Studies (Q = 1350.46, df = 116, p = 0.00; I² = 92.9%) 100.00% −0.25 [−0.49, −0.00]
−5
0
3
Hedge's G







ACQUIRED - Meta-regressions of Gray Matter by Volume

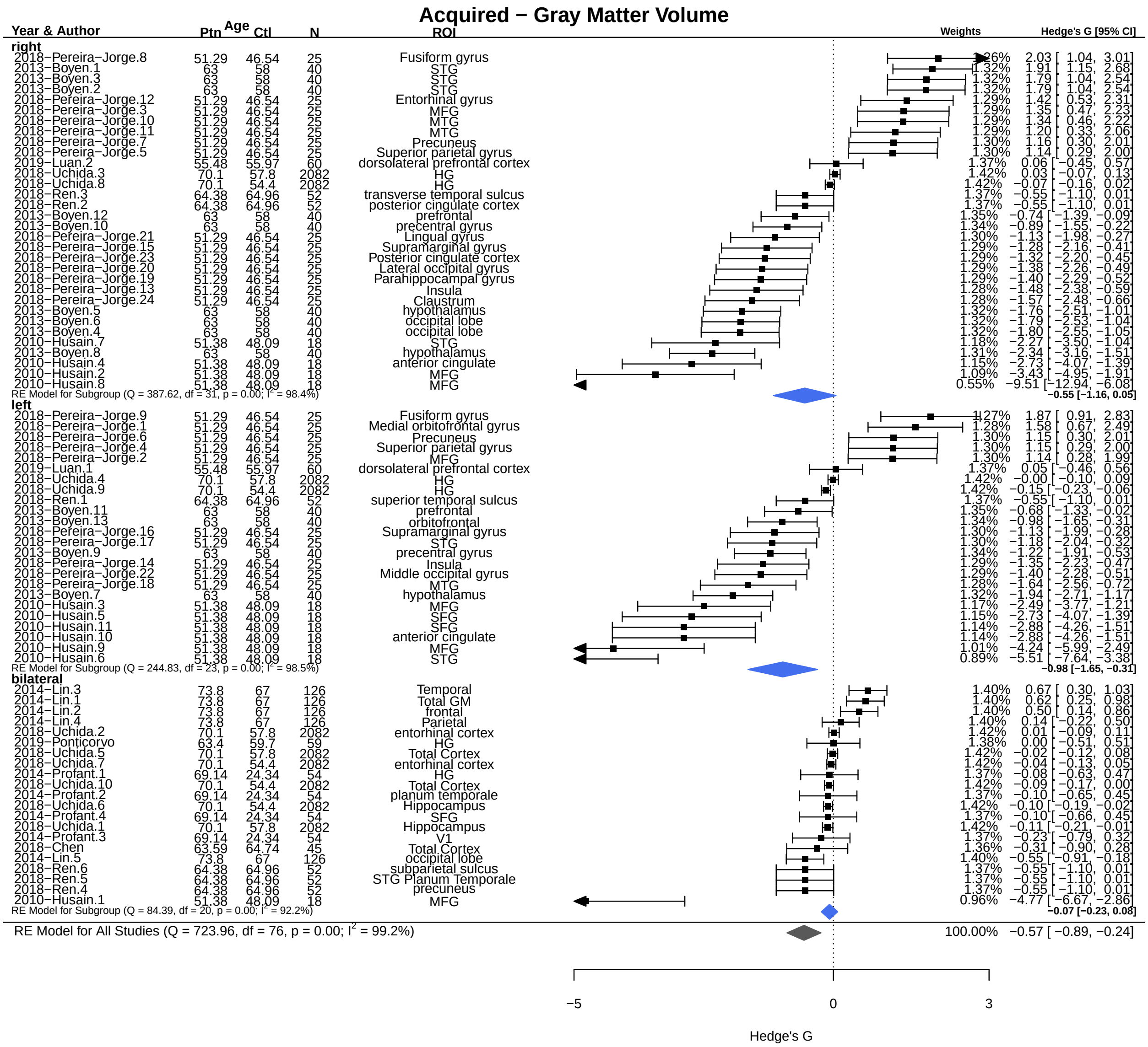
Random effects model no intercept covariated by Big area

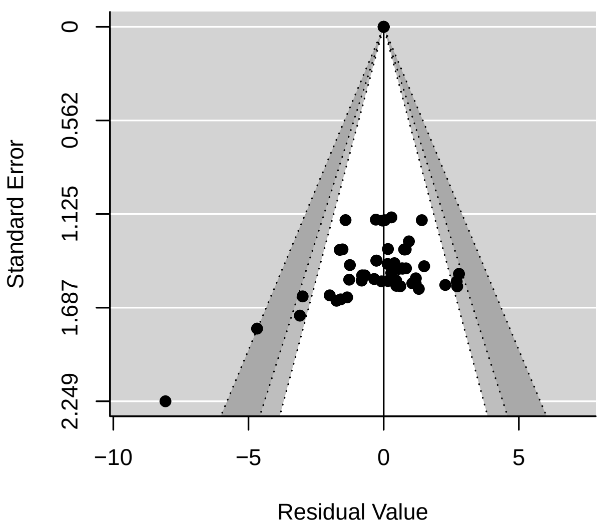
Table 10: Table continues below

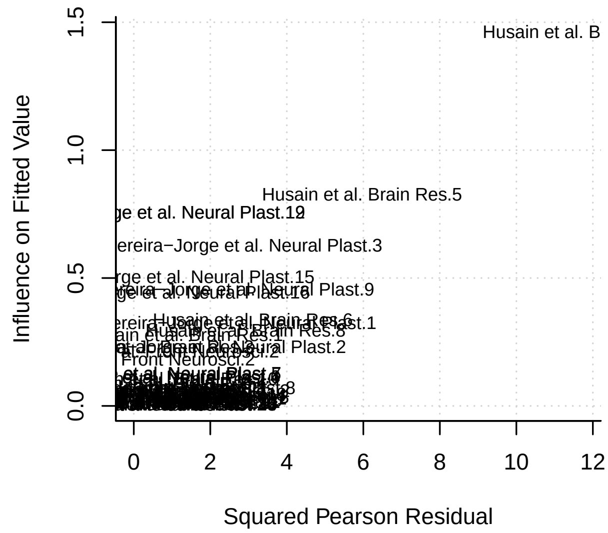
	HedgeG	se	zval	ci.lo	ci.up
left cingulate cortex	-2.883	1.728	-1.669	-6.269	0.5024
left frontal	-1.14	0.5268	-2.164	-2.173	-0.1076
left hypothalamus	-1.937	1.626	-1.191	-5.124	1.25
left insular cortex	-1.353	1.641	-0.8248	-4.57	1.863
left occipital	-1.398	1.642	-0.8514	-4.616	1.82
left parietal	0.3896	0.9454	0.4121	-1.463	2.243
left temporal lobe	-0.8302	0.6236	-1.331	-2.052	0.3921
right cingulate cortex	-1.483	0.954	-1.554	-3.352	0.3872

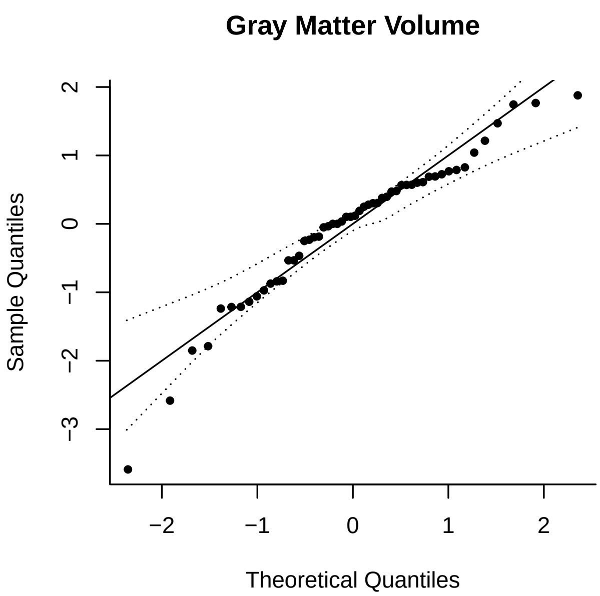
	HedgeG	se	zval	ci.lo	ci.up
right entorhinal	0.007072	1.161	0.006091	-2.269	2.283
right frontal	-1.438	0.7012	-2.05	-2.812	-0.06331
right hypothalamus	-2.047	1.151	-1.778	-4.304	0.2095
right insular cortex	-1.525	1.163	-1.311	-3.803	0.7542
right occipital	-1.524	0.8158	-1.868	-3.123	0.07522
right parietal	0.3405	0.9459	0.36	-1.513	2.194
right temporal lobe	0.727	0.5141	1.414	-0.2806	1.735

	pval
left cingulate cortex	0.09509
left frontal	0.03045
left hypothalamus	0.2335
left insular cortex	0.4095
left occipital	0.3945
left parietal	0.6803
left temporal lobe	0.1831
right cingulate cortex	0.1202
right entorhinal	0.9951
right frontal	0.04034
right hypothalamus	0.0754
right insular cortex	0.1898
right occipital	0.0618
right parietal	0.7189
right temporal lobe	0.1573


Acquired − Gray Matter Volume
Year & Author | Age: Ptn, Ctl | N | ROI | Weights | Hedge's G [95% CI]
right
2018−Pereira−Jorge.8 51.29 46.54 25 Fusiform gyrus 1.26% 2.03 [1.04, 3.01]
2013−Boyen.1 63 58 40 STG 1.32% 1.91 [1.15, 2.68]
2013−Boyen.3 63 58 40 STG 1.32% 1.79 [1.04, 2.54]
2013−Boyen.2 63 58 40 STG 1.32% 1.79 [1.04, 2.54]
2018−Pereira−Jorge.12 51.29 46.54 25 Entorhinal gyrus 1.29% 1.42 [0.53, 2.31]
2018−Pereira−Jorge.3 51.29 46.54 25 MFG 1.29% 1.35 [0.47, 2.23]
2018−Pereira−Jorge.10 51.29 46.54 25 MTG 1.29% 1.34 [0.46, 2.22]
2018−Pereira−Jorge.11 51.29 46.54 25 MTG 1.29% 1.20 [0.33, 2.06]
2018−Pereira−Jorge.7 51.29 46.54 25 Precuneus 1.30% 1.16 [0.30, 2.01]
2018−Pereira−Jorge.5 51.29 46.54 25 Superior parietal gyrus 1.30% 1.14 [0.29, 2.00]
2019−Luan.2 55.48 55.97 60 dorsolateral prefrontal cortex 1.37% 0.06 [−0.45, 0.57]
2018−Uchida.3 70.1 57.8 2082 HG 1.42% 0.03 [−0.07, 0.13]
2018−Uchida.8 70.1 54.4 2082 HG 1.42% −0.07 [−0.16, 0.02]
2018−Ren.3 64.38 64.96 52 transverse temporal sulcus 1.37% −0.55 [−1.10, 0.01]
2018−Ren.2 64.38 64.96 52 posterior cingulate cortex 1.37% −0.55 [−1.10, 0.01]
2013−Boyen.12 63 58 40 prefrontal 1.35% −0.74 [−1.39, −0.09]
2013−Boyen.10 63 58 40 precentral gyrus 1.34% −0.89 [−1.55, −0.22]
2018−Pereira−Jorge.21 51.29 46.54 25 Lingual gyrus 1.30% −1.13 [−1.98, −0.27]
2018−Pereira−Jorge.15 51.29 46.54 25 Supramarginal gyrus 1.29% −1.28 [−2.16, −0.41]
2018−Pereira−Jorge.23 51.29 46.54 25 Posterior cingulate cortex 1.29% −1.32 [−2.20, −0.45]
2018−Pereira−Jorge.20 51.29 46.54 25 Lateral occipital gyrus 1.29% −1.38 [−2.26, −0.49]
2018−Pereira−Jorge.19 51.29 46.54 25 Parahippocampal gyrus 1.29% −1.40 [−2.29, −0.52]
2018−Pereira−Jorge.13 51.29 46.54 25 Insula 1.28% −1.48 [−2.38, −0.59]
2018−Pereira−Jorge.24 51.29 46.54 25 Claustrum 1.28% −1.57 [−2.48, −0.66]
2013−Boyen.5 63 58 40 hypothalamus 1.32% −1.76 [−2.51, −1.01]
2013−Boyen.6 63 58 40 occipital lobe 1.32% −1.79 [−2.53, −1.04]
2013−Boyen.4 63 58 40 occipital lobe 1.32% −1.80 [−2.55, −1.05]
2010−Husain.7 51.38 48.09 18 STG 1.18% −2.27 [−3.50, −1.04]
2013−Boyen.8 63 58 40 hypothalamus 1.31% −2.34 [−3.16, −1.51]
2010−Husain.4 51.38 48.09 18 anterior cingulate 1.15% −2.73 [−4.07, −1.39]
2010−Husain.2 51.38 48.09 18 MFG 1.09% −3.43 [−4.95, −1.91]
2010−Husain.8 51.38 48.09 18 MFG 0.55% −9.51 [−12.94, −6.08]
RE Model for Subgroup (Q = 387.62, df = 31, p = 0.00; I² = 98.4%) −0.55 [−1.16, 0.05]
left
2018−Pereira−Jorge.9 51.29 46.54 25 Fusiform gyrus 1.27% 1.87 [0.91, 2.83]
2018−Pereira−Jorge.1 51.29 46.54 25 Medial orbitofrontal gyrus 1.28% 1.58 [0.67, 2.49]
2018−Pereira−Jorge.6 51.29 46.54 25 Precuneus 1.30% 1.15 [0.30, 2.01]
2018−Pereira−Jorge.4 51.29 46.54 25 Superior parietal gyrus 1.30% 1.15 [0.29, 2.00]
2018−Pereira−Jorge.2 51.29 46.54 25 MFG 1.30% 1.14 [0.28, 1.99]
2019−Luan.1 55.48 55.97 60 dorsolateral prefrontal cortex 1.37% 0.05 [−0.46, 0.56]
2018−Uchida.4 70.1 57.8 2082 HG 1.42% −0.00 [−0.10, 0.09]
2018−Uchida.9 70.1 54.4 2082 HG 1.42% −0.15 [−0.23, −0.06]
2018−Ren.1 64.38 64.96 52 superior temporal sulcus 1.37% −0.55 [−1.10, 0.01]
2013−Boyen.11 63 58 40 prefrontal 1.35% −0.68 [−1.33, −0.02]
2013−Boyen.13 63 58 40 orbitofrontal 1.34% −0.98 [−1.65, −0.31]
2018−Pereira−Jorge.16 51.29 46.54 25 Supramarginal gyrus 1.30% −1.13 [−1.99, −0.28]
2018−Pereira−Jorge.17 51.29 46.54 25 STG 1.30% −1.18 [−2.04, −0.32]
2013−Boyen.9 63 58 40 precentral gyrus 1.34% −1.22 [−1.91, −0.53]
2018−Pereira−Jorge.14 51.29 46.54 25 Insula 1.29% −1.35 [−2.23, −0.47]
2018−Pereira−Jorge.22 51.29 46.54 25 Middle occipital gyrus 1.29% −1.40 [−2.28, −0.51]
2018−Pereira−Jorge.18 51.29 46.54 25 MTG 1.28% −1.64 [−2.56, −0.72]
2013−Boyen.7 63 58 40 hypothalamus 1.32% −1.94 [−2.71, −1.17]
2010−Husain.3 51.38 48.09 18 MFG 1.17% −2.49 [−3.77, −1.21]
2010−Husain.5 51.38 48.09 18 SFG 1.15% −2.73 [−4.07, −1.39]
2010−Husain.11 51.38 48.09 18 SFG 1.14% −2.88 [−4.26, −1.51]
2010−Husain.10 51.38 48.09 18 anterior cingulate 1.14% −2.88 [−4.26, −1.51]
2010−Husain.9 51.38 48.09 18 MFG 1.01% −4.24 [−5.99, −2.49]
2010−Husain.6 51.38 48.09 18 STG 0.89% −5.51 [−7.64, −3.38]
RE Model for Subgroup (Q = 244.83, df = 23, p = 0.00; I² = 98.5%) −0.98 [−1.65, −0.31]
bilateral
2014−Lin.3 73.8 67 126 Temporal 1.40% 0.67 [0.30, 1.03]
2014−Lin.1 73.8 67 126 Total GM 1.40% 0.62 [0.25, 0.98]
2014−Lin.2 73.8 67 126 frontal 1.40% 0.50 [0.14, 0.86]
2014−Lin.4 73.8 67 126 Parietal 1.40% 0.14 [−0.22, 0.50]
2018−Uchida.2 70.1 57.8 2082 entorhinal cortex 1.42% 0.01 [−0.09, 0.11]
2019−Ponticorvo 63.4 59.7 59 HG 1.38% 0.00 [−0.51, 0.51]
2018−Uchida.5 70.1 57.8 2082 Total Cortex 1.42% −0.02 [−0.12, 0.08]
2018−Uchida.7 70.1 54.4 2082 entorhinal cortex 1.42% −0.04 [−0.13, 0.05]
2014−Profant.1 69.14 24.34 54 HG 1.37% −0.08 [−0.63, 0.47]
2018−Uchida.10 70.1 54.4 2082 Total Cortex 1.42% −0.09 [−0.17, 0.00]
2014−Profant.2 69.14 24.34 54 planum temporale 1.37% −0.10 [−0.65, 0.45]
2018−Uchida.6 70.1 54.4 2082 Hippocampus 1.42% −0.10 [−0.19, −0.02]
2014−Profant.4 69.14 24.34 54 SFG 1.37% −0.10 [−0.66, 0.45]
2018−Uchida.1 70.1 57.8 2082 Hippocampus 1.42% −0.11 [−0.21, −0.01]
2014−Profant.3 69.14 24.34 54 V1 1.37% −0.23 [−0.79, 0.32]
2018−Chen 63.59 64.74 45 Total Cortex 1.36% −0.31 [−0.90, 0.28]
2014−Lin.5 73.8 67 126 occipital lobe 1.40% −0.55 [−0.91, −0.18]
2018−Ren.6 64.38 64.96 52 subparietal sulcus 1.37% −0.55 [−1.10, 0.01]
2018−Ren.5 64.38 64.96 52 STG Planum Temporale 1.37% −0.55 [−1.10, 0.01]
2018−Ren.4 64.38 64.96 52 precuneus 1.37% −0.55 [−1.10, 0.01]
2010−Husain.1 51.38 48.09 18 MFG 0.96% −4.77 [−6.67, −2.86]
RE Model for Subgroup (Q = 84.39, df = 20, p = 0.00; I² = 92.2%) −0.07 [−0.23, 0.08]
RE Model for All Studies (Q = 723.96, df = 76, p = 0.00; I² = 99.2%) 100.00% −0.57 [−0.89, −0.24]
−5
0
3
Hedge's G





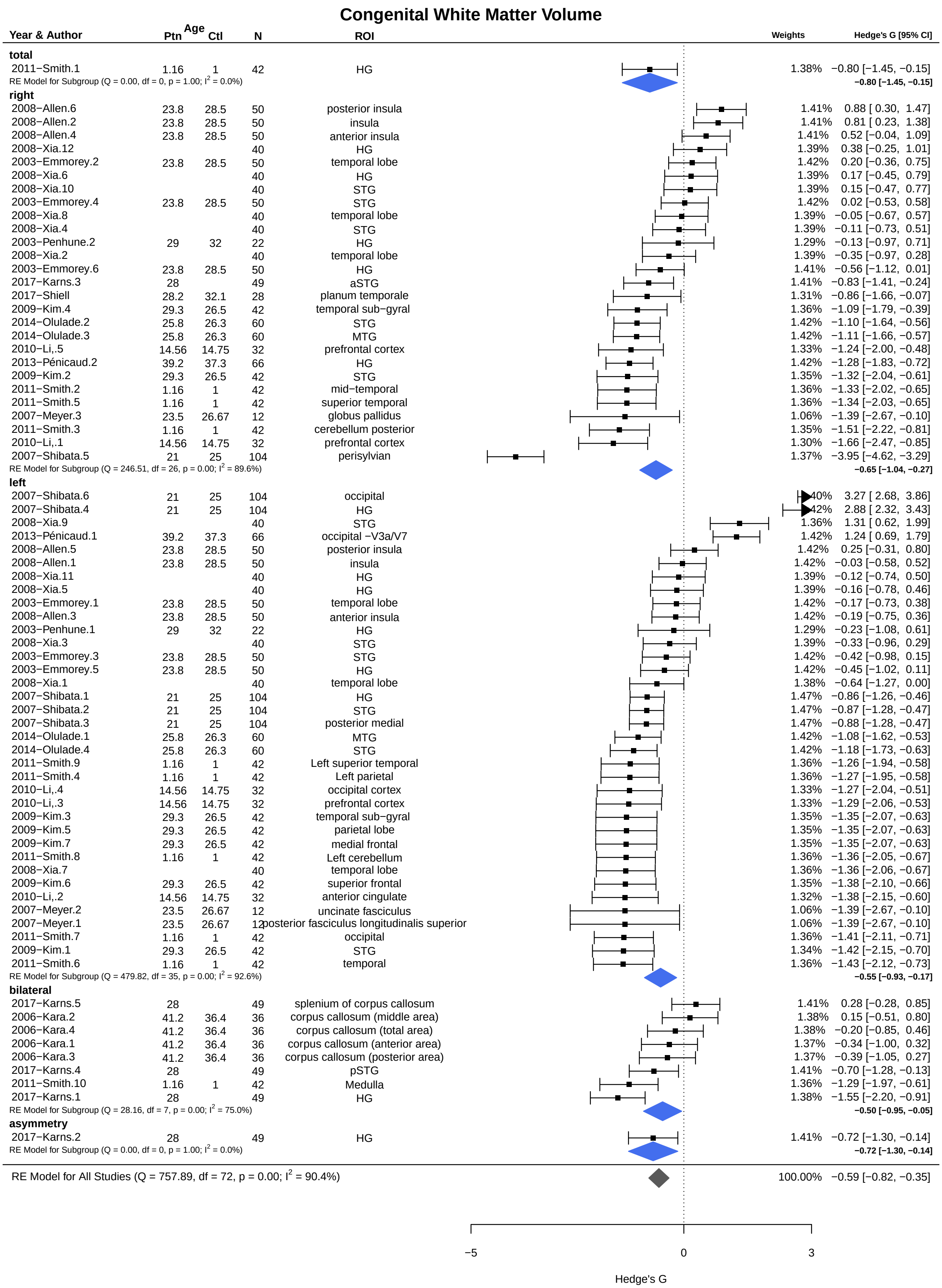


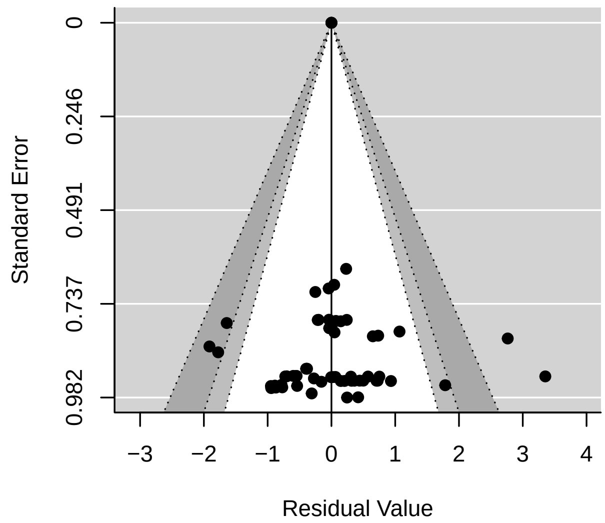
CONGENITAL - White Matter by VOLUME

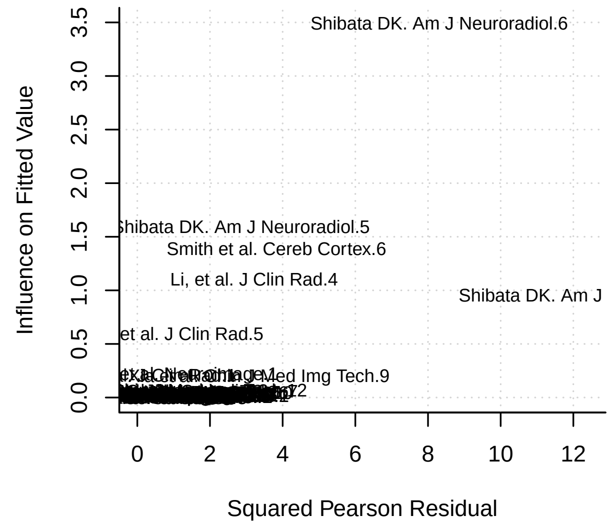
Random effects model no intercept covariated by Big area

	HedgeG	se	zval	ci.lo	ci.up	N
left cerebellum	-1.107	0.6745	-1.641	-2.429	0.2149	2
left cingulate cortex	-1.379	0.9926	-1.389	-3.324	0.5668	1
left frontal	-1.34	0.5684	-2.358	-2.454	-0.2262	3
left insular cortex	0.007913	0.5504	0.01438	-1.071	1.087	3
left occipital	0.5024	0.4846	1.037	-0.4475	1.452	4
left parietal	-1.308	0.6914	-1.892	-2.663	0.04705	2
left temporal lobe	-0.478	0.2211	-2.163	-0.9113	-0.04478	19
left tract	-1.386	0.7931	-1.747	-2.94	0.1688	2
right cerebellum	-1.513	0.9789	-1.546	-3.432	0.4051	1
right forebrain	-1.386	1.122	-1.235	-3.584	0.8126	1

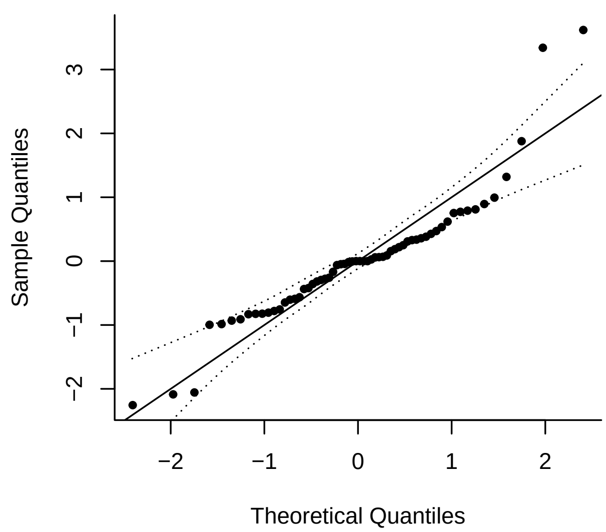
	HedgeG	se	zval	ci.lo	ci.up	N
right frontal	-2.31	0.5697	-4.055	-3.426	-1.193	3
right insular cortex	0.737	0.5521	1.335	-0.3451	1.819	3
right temporal lobe	-0.5529	0.2218	-2.493	-0.9875	-0.1183	19


Congenital White Matter Volume
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
total
2011−Smith.1 1.16 1 42 HG 1.38% −0.80 [−1.45, −0.15]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.80 [−1.45, −0.15]
right
2008−Allen.6 23.8 28.5 50 posterior insula 1.41% 0.88 [0.30, 1.47]
2008−Allen.2 23.8 28.5 50 insula 1.41% 0.81 [0.23, 1.38]
2008−Allen.4 23.8 28.5 50 anterior insula 1.41% 0.52 [−0.04, 1.09]
2008−Xia.12 40 HG 1.39% 0.38 [−0.25, 1.01]
2003−Emmorey.2 23.8 28.5 50 temporal lobe 1.42% 0.20 [−0.36, 0.75]
2008−Xia.6 40 HG 1.39% 0.17 [−0.45, 0.79]
2008−Xia.10 40 STG 1.39% 0.15 [−0.47, 0.77]
2003−Emmorey.4 23.8 28.5 50 STG 1.42% 0.02 [−0.53, 0.58]
2008−Xia.8 40 temporal lobe 1.39% −0.05 [−0.67, 0.57]
2008−Xia.4 40 STG 1.39% −0.11 [−0.73, 0.51]
2003−Penhune.2 29 32 22 HG 1.29% −0.13 [−0.97, 0.71]
2008−Xia.2 40 temporal lobe 1.39% −0.35 [−0.97, 0.28]
2003−Emmorey.6 23.8 28.5 50 HG 1.41% −0.56 [−1.12, 0.01]
2017−Karns.3 28 49 aSTG 1.41% −0.83 [−1.41, −0.24]
2017−Shiell 28.2 32.1 28 planum temporale 1.31% −0.86 [−1.66, −0.07]
2009−Kim.4 29.3 26.5 42 temporal sub−gyral 1.36% −1.09 [−1.79, −0.39]
2014−Olulade.2 25.8 26.3 60 STG 1.42% −1.10 [−1.64, −0.56]
2014−Olulade.3 25.8 26.3 60 MTG 1.42% −1.11 [−1.66, −0.57]
2010−Li,.5 14.56 14.75 32 prefrontal cortex 1.33% −1.24 [−2.00, −0.48]
2013−Pénicaud.2 39.2 37.3 66 HG 1.42% −1.28 [−1.83, −0.72]
2009−Kim.2 29.3 26.5 42 STG 1.35% −1.32 [−2.04, −0.61]
2011−Smith.2 1.16 1 42 mid−temporal 1.36% −1.33 [−2.02, −0.65]
2011−Smith.5 1.16 1 42 superior temporal 1.36% −1.34 [−2.03, −0.65]
2007−Meyer.3 23.5 26.67 12 globus pallidus 1.06% −1.39 [−2.67, −0.10]
2011−Smith.3 1.16 1 42 cerebellum posterior 1.35% −1.51 [−2.22, −0.81]
2010−Li,.1 14.56 14.75 32 prefrontal cortex 1.30% −1.66 [−2.47, −0.85]
2007−Shibata.5 21 25 104 perisylvian 1.37% −3.95 [−4.62, −3.29]
RE Model for Subgroup (Q = 246.51, df = 26, p = 0.00; I² = 89.6%) −0.65 [−1.04, −0.27]
left
2007−Shibata.6 21 25 104 occipital 1.40% 3.27 [2.68, 3.86]
2007−Shibata.4 21 25 104 HG 1.42% 2.88 [2.32, 3.43]
2008−Xia.9 40 STG 1.36% 1.31 [0.62, 1.99]
2013−Pénicaud.1 39.2 37.3 66 occipital −V3a/V7 1.42% 1.24 [0.69, 1.79]
2008−Allen.5 23.8 28.5 50 posterior insula 1.42% 0.25 [−0.31, 0.80]
2008−Allen.1 23.8 28.5 50 insula 1.42% −0.03 [−0.58, 0.52]
2008−Xia.11 40 HG 1.39% −0.12 [−0.74, 0.50]
2008−Xia.5 40 HG 1.39% −0.16 [−0.78, 0.46]
2003−Emmorey.1 23.8 28.5 50 temporal lobe 1.42% −0.17 [−0.73, 0.38]
2008−Allen.3 23.8 28.5 50 anterior insula 1.42% −0.19 [−0.75, 0.36]
2003−Penhune.1 29 32 22 HG 1.29% −0.23 [−1.08, 0.61]
2008−Xia.3 40 STG 1.39% −0.33 [−0.96, 0.29]
2003−Emmorey.3 23.8 28.5 50 STG 1.42% −0.42 [−0.98, 0.15]
2003−Emmorey.5 23.8 28.5 50 HG 1.42% −0.45 [−1.02, 0.11]
2008−Xia.1 40 temporal lobe 1.38% −0.64 [−1.27, 0.00]
2007−Shibata.1 21 25 104 HG 1.47% −0.86 [−1.26, −0.46]
2007−Shibata.2 21 25 104 STG 1.47% −0.87 [−1.28, −0.47]
2007−Shibata.3 21 25 104 posterior medial 1.47% −0.88 [−1.28, −0.47]
2014−Olulade.1 25.8 26.3 60 MTG 1.42% −1.08 [−1.62, −0.53]
2014−Olulade.4 25.8 26.3 60 STG 1.42% −1.18 [−1.73, −0.63]
2011−Smith.9 1.16 1 42 Left superior temporal 1.36% −1.26 [−1.94, −0.58]
2011−Smith.4 1.16 1 42 Left parietal 1.36% −1.27 [−1.95, −0.58]
2010−Li,.4 14.56 14.75 32 occipital cortex 1.33% −1.27 [−2.04, −0.51]
2010−Li,.3 14.56 14.75 32 prefrontal cortex 1.33% −1.29 [−2.06, −0.53]
2009−Kim.3 29.3 26.5 42 temporal sub−gyral 1.35% −1.35 [−2.07, −0.63]
2009−Kim.5 29.3 26.5 42 parietal lobe 1.35% −1.35 [−2.07, −0.63]
2009−Kim.7 29.3 26.5 42 medial frontal 1.35% −1.35 [−2.07, −0.63]
2011−Smith.8 1.16 1 42 Left cerebellum 1.36% −1.36 [−2.05, −0.67]
2008−Xia.7 40 temporal lobe 1.36% −1.36 [−2.06, −0.67]
2009−Kim.6 29.3 26.5 42 superior frontal 1.35% −1.38 [−2.10, −0.66]
2010−Li,.2 14.56 14.75 32 anterior cingulate 1.32% −1.38 [−2.15, −0.60]
2007−Meyer.2 23.5 26.67 12 uncinate fasciculus 1.06% −1.39 [−2.67, −0.10]
2007−Meyer.1 23.5 26.67 12 posterior fasciculus longitudinalis superior 1.06% −1.39 [−2.67, −0.10]
2011−Smith.7 1.16 1 42 occipital 1.36% −1.41 [−2.11, −0.71]
2009−Kim.1 29.3 26.5 42 STG 1.34% −1.42 [−2.15, −0.70]
2011−Smith.6 1.16 1 42 temporal 1.36% −1.43 [−2.12, −0.73]
RE Model for Subgroup (Q = 479.82, df = 35, p = 0.00; I² = 92.6%) −0.55 [−0.93, −0.17]
bilateral
2017−Karns.5 28 49 splenium of corpus callosum 1.41% 0.28 [−0.28, 0.85]
2006−Kara.2 41.2 36.4 36 corpus callosum (middle area) 1.38% 0.15 [−0.51, 0.80]
2006−Kara.4 41.2 36.4 36 corpus callosum (total area) 1.38% −0.20 [−0.85, 0.46]
2006−Kara.1 41.2 36.4 36 corpus callosum (anterior area) 1.37% −0.34 [−1.00, 0.32]
2006−Kara.3 41.2 36.4 36 corpus callosum (posterior area) 1.37% −0.39 [−1.05, 0.27]
2017−Karns.4 28 49 pSTG 1.41% −0.70 [−1.28, −0.13]
2011−Smith.10 1.16 1 42 Medulla 1.36% −1.29 [−1.97, −0.61]
2017−Karns.1 28 49 HG 1.38% −1.55 [−2.20, −0.91]
RE Model for Subgroup (Q = 28.16, df = 7, p = 0.00; I² = 75.0%) −0.50 [−0.95, −0.05]
asymmetry
2017−Karns.2 28 49 HG 1.41% −0.72 [−1.30, −0.14]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.72 [−1.30, −0.14]
RE Model for All Studies (Q = 757.89, df = 72, p = 0.00; I² = 90.4%) 100.00% −0.59 [−0.82, −0.35]
−5
0
3
Hedge's G



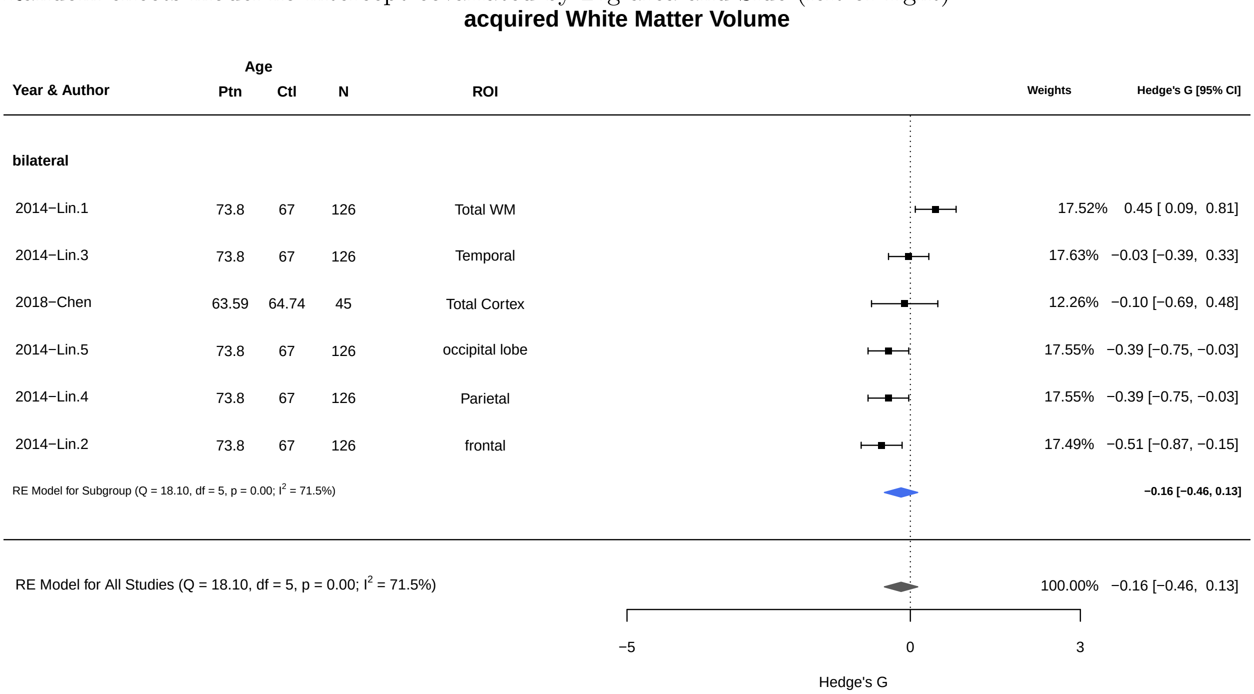


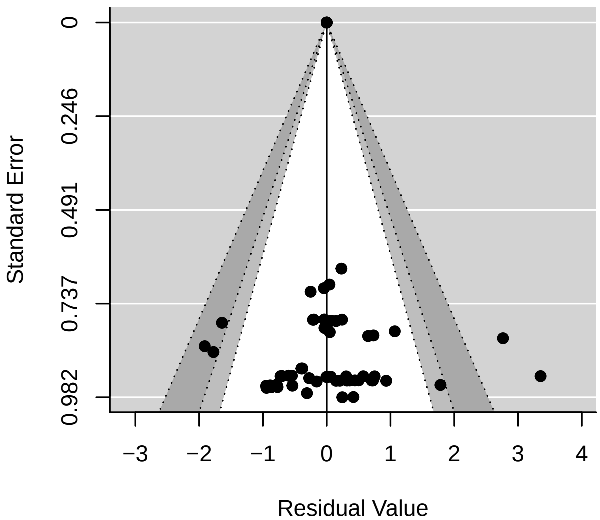
Congenital White Matter Volume

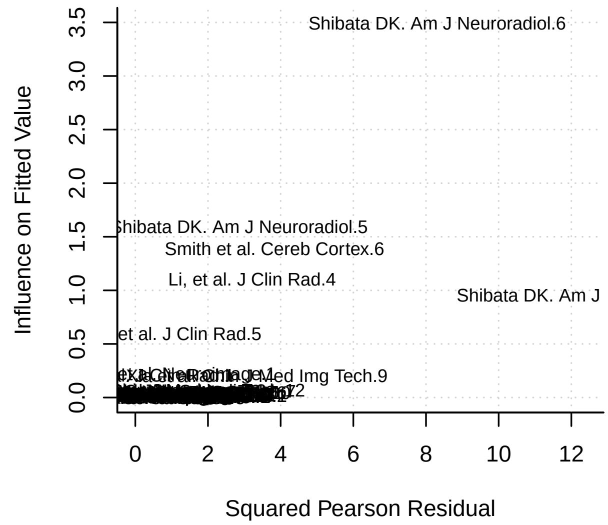


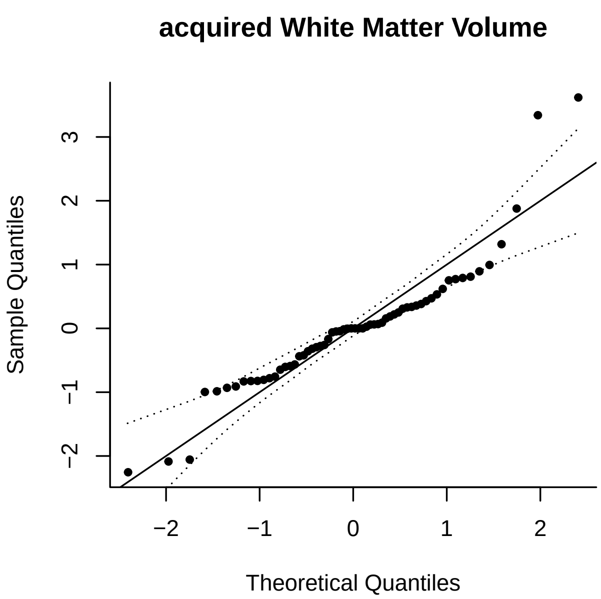
ACQUIRED - White Matter by VOLUME

Random effects model no intercept covariated by Big area and Side (left or right)







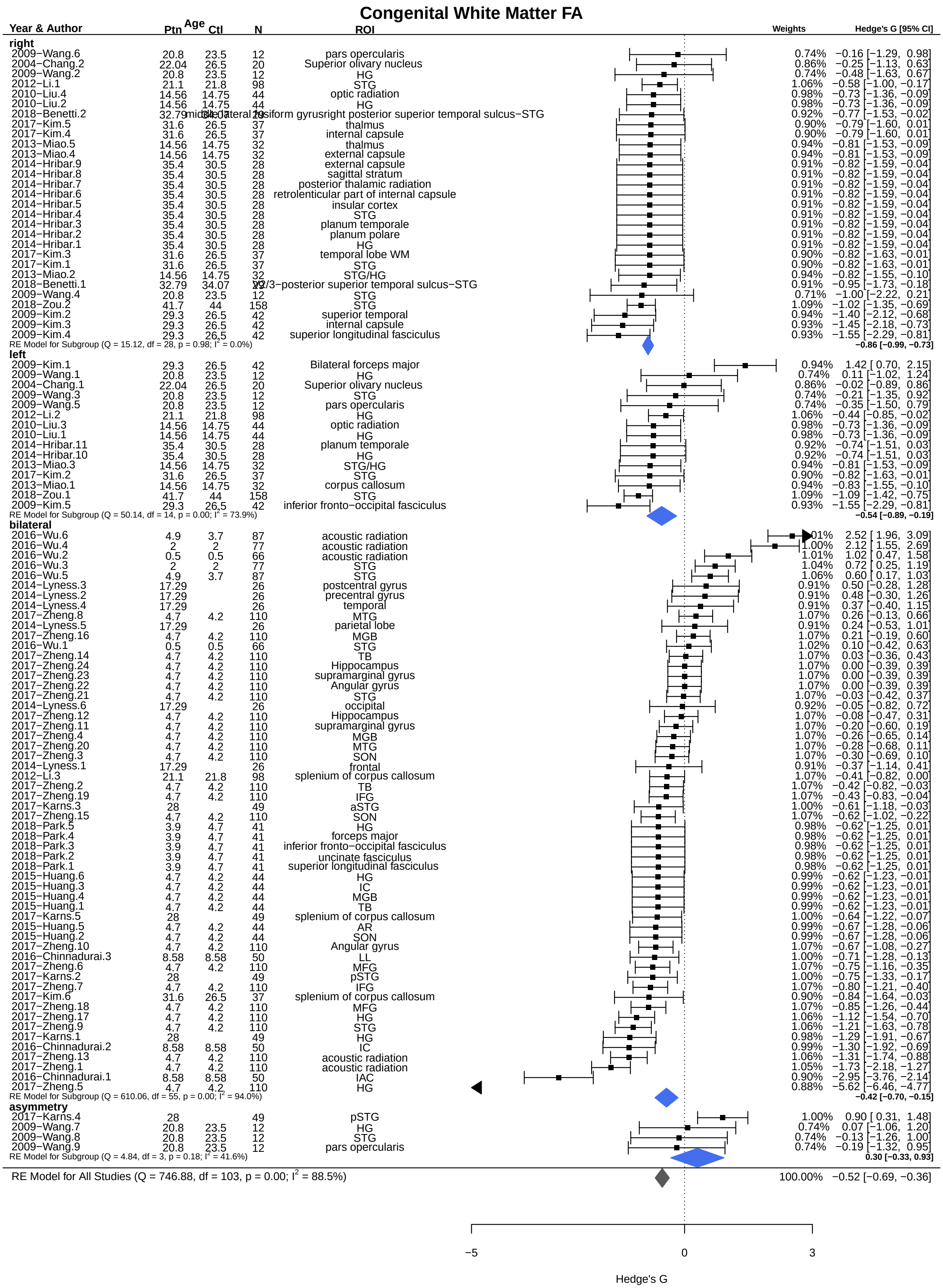


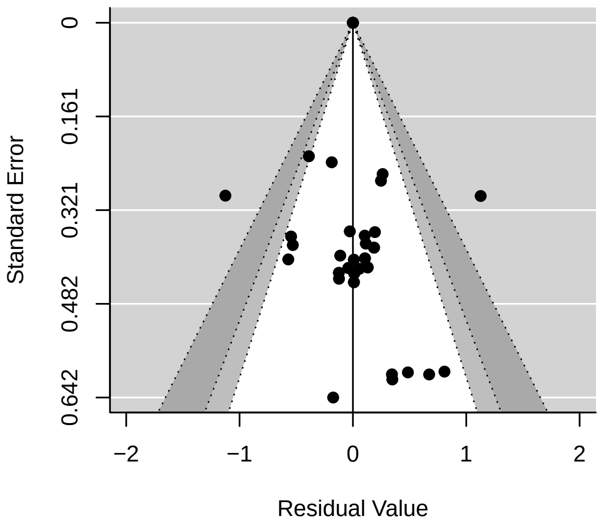
CONGENITAL - White Matter by FA fractional anisotropy

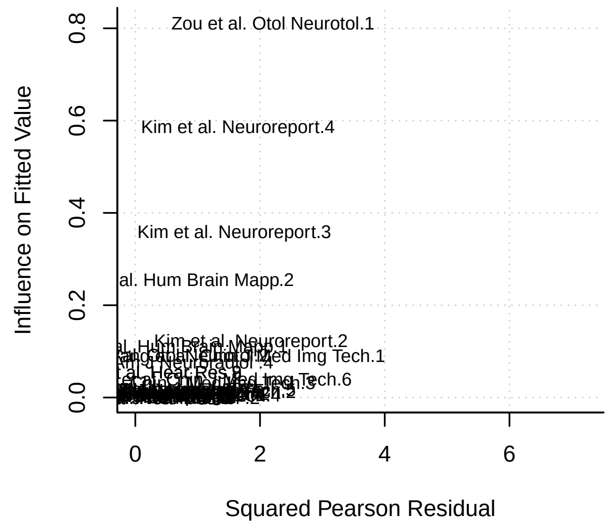
Random effects model no intercept covariated by Big area

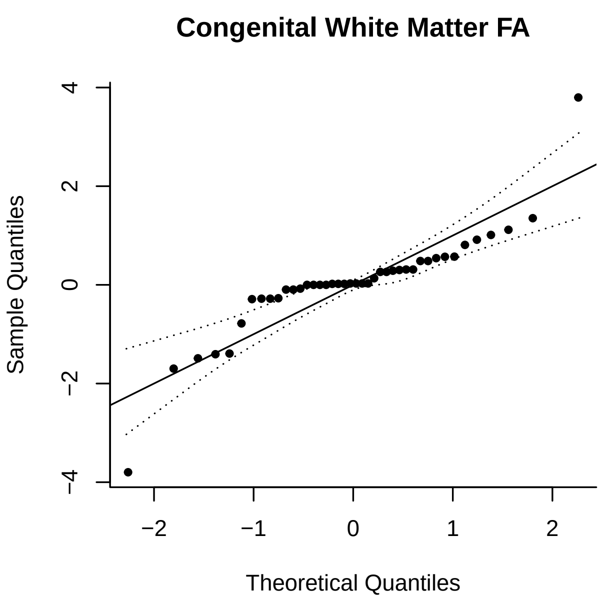
	HedgeG	se	zval	ci.lo	ci.up	N
left brainstem	-0.01557	0.4891	-0.03183	-0.9742	0.9431	1
left cingulate cortex	0.297	0.2965	1.002	-0.2841	0.8781	2
left occipital	-0.7254	0.3791	-1.914	-1.468	0.01755	1
left temporal lobe	-0.698	0.1265	-5.518	-0.946	-0.4501	10
left tract	-1.549	0.425	-3.645	-2.382	-0.7163	1
right brainstem	-0.2476	0.4908	-0.5044	-1.21	0.7145	1
right insular cortex	-0.8178	0.4415	-1.852	-1.683	0.04759	1
right occipital	-0.7254	0.3791	-1.914	-1.468	0.01755	1
right temporal lobe	-0.8298	0.1036	-8.013	-1.033	-0.6269	16
right thalmus	-0.9238	0.1789	-5.164	-1.274	-0.5732	6

	HedgeG	se	zval	ci.lo	ci.up	N
right tract	-1.004	0.2156	-4.656	-1.427	-0.5813	4


Congenital White Matter FA
Year & Author | Age Ptn | Ctl | N | ROI | Weights | Hedge's G [95% CI]
right
2009−Wang.6 20.8 23.5 12 pars opercularis 0.74% −0.16 [−1.29, 0.98]
2004−Chang.2 22.04 26.5 20 Superior olivary nucleus 0.86% −0.25 [−1.13, 0.63]
2009−Wang.2 20.8 23.5 12 HG 0.74% −0.48 [−1.63, 0.67]
2012−Li.1 21.1 21.8 98 STG 1.06% −0.58 [−1.00, −0.17]
2010−Liu.4 14.56 14.75 44 optic radiation 0.98% −0.73 [−1.36, −0.09]
2010−Liu.2 14.56 14.75 44 HG 0.98% −0.73 [−1.36, −0.09]
2018−Benetti.2 32.79 34.07 29 middle lateral fusiform gyrus right posterior superior temporal sulcus−STG 0.92% −0.77 [−1.53, −0.02]
2017−Kim.5 31.6 26.5 37 thalmus 0.90% −0.79 [−1.60, 0.01]
2017−Kim.4 31.6 26.5 37 internal capsule 0.90% −0.79 [−1.60, 0.01]
2013−Miao.5 14.56 14.75 32 thalmus 0.94% −0.81 [−1.53, −0.09]
2013−Miao.4 14.56 14.75 32 external capsule 0.94% −0.81 [−1.53, −0.09]
2014−Hribar.9 35.4 30.5 28 external capsule 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.8 35.4 30.5 28 sagittal stratum 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.7 35.4 30.5 28 posterior thalamic radiation 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.6 35.4 30.5 28 retrolenticular part of internal capsule 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.5 35.4 30.5 28 insular cortex 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.4 35.4 30.5 28 STG 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.3 35.4 30.5 28 planum temporale 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.2 35.4 30.5 28 planum polare 0.91% −0.82 [−1.59, −0.04]
2014−Hribar.1 35.4 30.5 28 HG 0.91% −0.82 [−1.59, −0.04]
2017−Kim.3 31.6 26.5 37 temporal lobe WM 0.90% −0.82 [−1.63, −0.01]
2017−Kim.1 31.6 26.5 37 STG 0.90% −0.82 [−1.63, −0.01]
2013−Miao.2 14.56 14.75 32 STG/HG 0.94% −0.82 [−1.55, −0.10]
2018−Benetti.1 32.79 34.07 29 2/3−posterior superior temporal sulcus−STG 0.91% −0.95 [−1.73, −0.18]
2009−Wang.4 20.8 23.5 12 STG 0.71% −1.00 [−2.22, 0.21]
2018−Zou.2 41.7 44 158 STG 1.09% −1.02 [−1.35, −0.69]
2009−Kim.2 29.3 26.5 42 superior temporal 0.94% −1.40 [−2.12, −0.68]
2009−Kim.3 29.3 26.5 42 internal capsule 0.93% −1.45 [−2.18, −0.73]
2009−Kim.4 29.3 26.5 42 superior longitudinal fasciculus 0.93% −1.55 [−2.29, −0.81]
RE Model for Subgroup (Q = 15.12, df = 28, p = 0.98; I² = 0.0%) −0.86 [−0.99, −0.73]
left
2009−Kim.1 29.3 26.5 42 Bilateral forceps major 0.94% 1.42 [0.70, 2.15]
2009−Wang.1 20.8 23.5 12 HG 0.74% 0.11 [−1.02, 1.24]
2004−Chang.1 22.04 26.5 20 Superior olivary nucleus 0.86% −0.02 [−0.89, 0.86]
2009−Wang.3 20.8 23.5 12 STG 0.74% −0.21 [−1.35, 0.92]
2009−Wang.5 20.8 23.5 12 pars opercularis 0.74% −0.35 [−1.50, 0.79]
2012−Li.2 21.1 21.8 98 HG 1.06% −0.44 [−0.85, −0.02]
2010−Liu.3 14.56 14.75 44 optic radiation 0.98% −0.73 [−1.36, −0.09]
2010−Liu.1 14.56 14.75 44 HG 0.98% −0.73 [−1.36, −0.09]
2014−Hribar.11 35.4 30.5 28 planum temporale 0.92% −0.74 [−1.51, 0.03]
2014−Hribar.10 35.4 30.5 28 HG 0.92% −0.74 [−1.51, 0.03]
2013−Miao.3 14.56 14.75 32 STG/HG 0.94% −0.81 [−1.53, −0.09]
2017−Kim.2 31.6 26.5 37 STG 0.90% −0.82 [−1.63, −0.01]
2013−Miao.1 14.56 14.75 32 corpus callosum 0.94% −0.83 [−1.55, −0.10]
2018−Zou.1 41.7 44 158 STG 1.09% −1.09 [−1.42, −0.75]
2009−Kim.5 29.3 26.5 42 inferior fronto−occipital fasciculus 0.93% −1.55 [−2.29, −0.81]
RE Model for Subgroup (Q = 50.14, df = 14, p = 0.00; I² = 73.9%) −0.54 [−0.89, −0.19]
bilateral
2016−Wu.6 4.9 3.7 87 acoustic radiation 1.01% 2.52 [1.96, 3.09]
2016−Wu.4 2 2 77 acoustic radiation 1.00% 2.12 [1.55, 2.69]
2016−Wu.2 0.5 0.5 66 acoustic radiation 1.01% 1.02 [0.47, 1.58]
2016−Wu.3 2 2 77 STG 1.04% 0.72 [0.25, 1.19]
2016−Wu.5 4.9 3.7 87 STG 1.06% 0.60 [0.17, 1.03]
2014−Lyness.3 17.29 26 postcentral gyrus 0.91% 0.50 [−0.28, 1.28]
2014−Lyness.2 17.29 26 precentral gyrus 0.91% 0.48 [−0.30, 1.26]
2014−Lyness.4 17.29 26 temporal 0.91% 0.37 [−0.40, 1.15]
2017−Zheng.8 4.7 4.2 110 MTG 1.07% 0.26 [−0.13, 0.66]
2014−Lyness.5 17.29 26 parietal lobe 0.91% 0.24 [−0.53, 1.01]
2017−Zheng.16 4.7 4.2 110 MGB 1.07% 0.21 [−0.19, 0.60]
2016−Wu.1 0.5 0.5 66 STG 1.02% 0.10 [−0.42, 0.63]
2017−Zheng.14 4.7 4.2 110 TB 1.07% 0.03 [−0.36, 0.43]
2017−Zheng.24 4.7 4.2 110 Hippocampus 1.07% 0.00 [−0.39, 0.39]
2017−Zheng.23 4.7 4.2 110 supramarginal gyrus 1.07% 0.00 [−0.39, 0.39]
2017−Zheng.22 4.7 4.2 110 Angular gyrus 1.07% 0.00 [−0.39, 0.39]
2017−Zheng.21 4.7 4.2 110 STG 1.07% −0.03 [−0.42, 0.37]
2014−Lyness.6 17.29 26 occipital 0.92% −0.05 [−0.82, 0.72]
2017−Zheng.12 4.7 4.2 110 Hippocampus 1.07% −0.08 [−0.47, 0.31]
2017−Zheng.11 4.7 4.2 110 supramarginal gyrus 1.07% −0.20 [−0.60, 0.19]
2017−Zheng.4 4.7 4.2 110 MGB 1.07% −0.26 [−0.65, 0.14]
2017−Zheng.20 4.7 4.2 110 MTG 1.07% −0.28 [−0.68, 0.11]
2017−Zheng.3 4.7 4.2 110 SON 1.07% −0.30 [−0.69, 0.10]
2014−Lyness.1 17.29 26 frontal 0.91% −0.37 [−1.14, 0.41]
2012−Li.3 21.1 21.8 98 splenium of corpus callosum 1.07% −0.41 [−0.82, 0.00]
2017−Zheng.2 4.7 4.2 110 TB 1.07% −0.42 [−0.82, −0.03]
2017−Zheng.19 4.7 4.2 110 IFG 1.07% −0.43 [−0.83, −0.04]
2017−Karns.3 28 49 aSTG 1.00% −0.61 [−1.18, −0.03]
2017−Zheng.15 4.7 4.2 110 SON 1.07% −0.62 [−1.02, −0.22]
2018−Park.5 3.9 4.7 41 HG 0.98% −0.62 [−1.25, 0.01]
2018−Park.4 3.9 4.7 41 forceps major 0.98% −0.62 [−1.25, 0.01]
2018−Park.3 3.9 4.7 41 inferior fronto−occipital fasciculus 0.98% −0.62 [−1.25, 0.01]
2018−Park.2 3.9 4.7 41 uncinate fasciculus 0.98% −0.62 [−1.25, 0.01]
2018−Park.1 3.9 4.7 41 superior longitudinal fasciculus 0.98% −0.62 [−1.25, 0.01]
2015−Huang.6 4.7 4.2 44 HG 0.99% −0.62 [−1.23, −0.01]
2015−Huang.3 4.7 4.2 44 IC 0.99% −0.62 [−1.23, −0.01]
2015−Huang.4 4.7 4.2 44 MGB 0.99% −0.62 [−1.23, −0.01]
2015−Huang.1 4.7 4.2 44 TB 0.99% −0.62 [−1.23, −0.01]
2017−Karns.5 28 49 splenium of corpus callosum 1.00% −0.64 [−1.22, −0.07]
2015−Huang.5 4.7 4.2 44 AR 0.99% −0.67 [−1.28, −0.06]
2015−Huang.2 4.7 4.2 44 SON 0.99% −0.67 [−1.28, −0.06]
2017−Zheng.10 4.7 4.2 110 Angular gyrus 1.07% −0.67 [−1.08, −0.27]
2016−Chinnadurai.3 8.58 8.58 50 LL 1.00% −0.71 [−1.28, −0.13]
2017−Zheng.6 4.7 4.2 110 MFG 1.07% −0.75 [−1.16, −0.35]
2017−Karns.2 28 49 pSTG 1.00% −0.75 [−1.33, −0.17]
2017−Zheng.7 4.7 4.2 110 IFG 1.07% −0.80 [−1.21, −0.40]
2017−Kim.6 31.6 26.5 37 splenium of corpus callosum 0.90% −0.84 [−1.64, −0.03]
2017−Zheng.18 4.7 4.2 110 MFG 1.07% −0.85 [−1.26, −0.44]
2017−Zheng.17 4.7 4.2 110 HG 1.06% −1.12 [−1.54, −0.70]
2017−Zheng.9 4.7 4.2 110 STG 1.06% −1.21 [−1.63, −0.78]
2017−Karns.1 28 49 HG 0.98% −1.29 [−1.91, −0.67]
2016−Chinnadurai.2 8.58 8.58 50 IC 0.99% −1.30 [−1.92, −0.69]
2017−Zheng.13 4.7 4.2 110 acoustic radiation 1.06% −1.31 [−1.74, −0.88]
2017−Zheng.1 4.7 4.2 110 acoustic radiation 1.05% −1.73 [−2.18, −1.27]
2016−Chinnadurai.1 8.58 8.58 50 IAC 0.90% −2.95 [−3.76, −2.14]
2017−Zheng.5 4.7 4.2 110 HG 0.88% −5.62 [−6.46, −4.77]
RE Model for Subgroup (Q = 610.06, df = 55, p = 0.00; I² = 94.0%) −0.42 [−0.70, −0.15]
asymmetry
2017−Karns.4 28 49 pSTG 1.00% 0.90 [0.31, 1.48]
2009−Wang.7 20.8 23.5 12 HG 0.74% 0.07 [−1.06, 1.20]
2009−Wang.8 20.8 23.5 12 STG 0.74% −0.13 [−1.26, 1.00]
2009−Wang.9 20.8 23.5 12 pars opercularis 0.74% −0.19 [−1.32, 0.95]
RE Model for Subgroup (Q = 4.84, df = 3, p = 0.18; I² = 41.6%) 0.30 [−0.33, 0.93]
RE Model for All Studies (Q = 746.88, df = 103, p = 0.00; I² = 88.5%) 100.00% −0.52 [−0.69, −0.36]
−5
0
3
Hedge's G



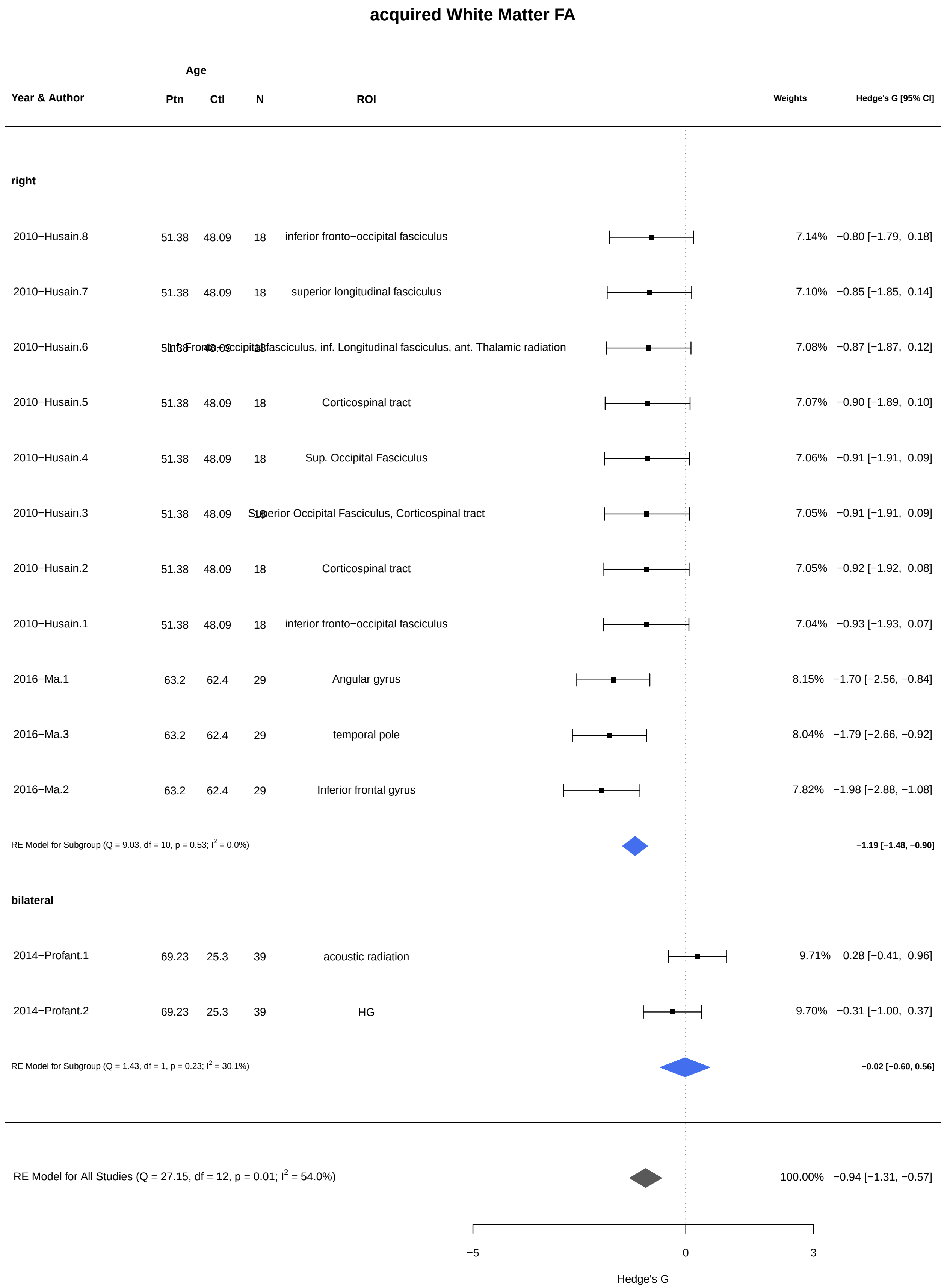


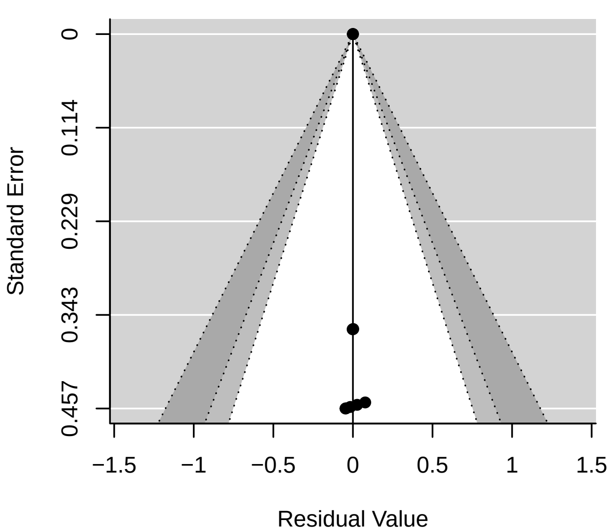


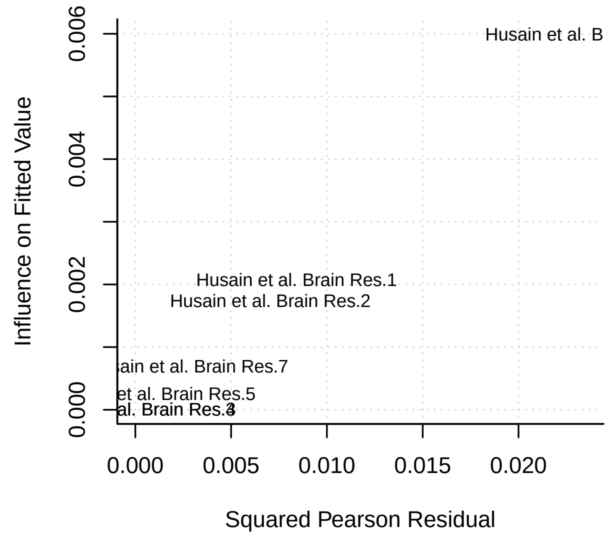
ACQUIRED - White Matter by FA fractional anisotropy

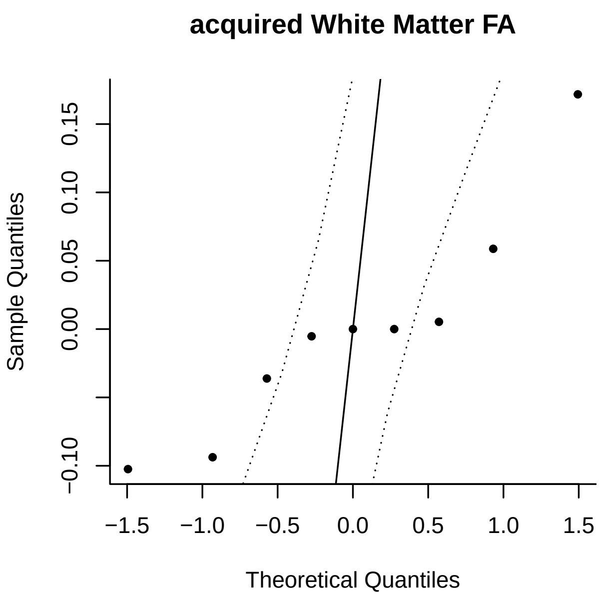
Random effects model no intercept covariated by Big area

	HedgeG	se	zval	ci.lo	ci.up	N
right frontal	-0.8736	0.5076	-1.721	-1.868	0.1212	1
right frontal lobe	-1.976	0.4587	-4.308	-2.875	-1.077	1
right occipital	-0.9105	0.3603	-2.527	-1.617	-0.2042	2
right parietal lobe	-1.703	0.4379	-3.888	-2.561	-0.8443	1
right temporal lobe	-1.793	0.4446	-4.034	-2.665	-0.922	1
right tract	-0.8812	0.2272	-3.878	-1.326	-0.4359	5


acquired White Matter FA
Age
Year & Author
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2010−Husain.8 51.38 48.09 18 inferior fronto−occipital fasciculus 7.14% −0.80 [−1.79, 0.18]
2010−Husain.7 51.38 48.09 18 superior longitudinal fasciculus 7.10% −0.85 [−1.85, 0.14]
2010−Husain.6 51.38 48.09 18 Inf. Fronto-occipital fasciculus, inf. Longitudinal fasciculus, ant. Thalamic radiation 7.08% −0.87 [−1.87, 0.12]
2010−Husain.5 51.38 48.09 18 Corticospinal tract 7.07% −0.90 [−1.89, 0.10]
2010−Husain.4 51.38 48.09 18 Sup. Occipital Fasciculus 7.06% −0.91 [−1.91, 0.09]
2010−Husain.3 51.38 48.09 18 Superior Occipital Fasciculus, Corticospinal tract 7.05% −0.91 [−1.91, 0.09]
2010−Husain.2 51.38 48.09 18 Corticospinal tract 7.05% −0.92 [−1.92, 0.08]
2010−Husain.1 51.38 48.09 18 inferior fronto−occipital fasciculus 7.04% −0.93 [−1.93, 0.07]
2016−Ma.1 63.2 62.4 29 Angular gyrus 8.15% −1.70 [−2.56, −0.84]
2016−Ma.3 63.2 62.4 29 temporal pole 8.04% −1.79 [−2.66, −0.92]
2016−Ma.2 63.2 62.4 29 Inferior frontal gyrus 7.82% −1.98 [−2.88, −1.08]
RE Model for Subgroup (Q = 9.03, df = 10, p = 0.53; I² = 0.0%) −1.19 [−1.48, −0.90]
bilateral
2014−Profant.1 69.23 25.3 39 acoustic radiation 9.71% 0.28 [−0.41, 0.96]
2014−Profant.2 69.23 25.3 39 HG 9.70% −0.31 [−1.00, 0.37]
RE Model for Subgroup (Q = 1.43, df = 1, p = 0.23; I² = 30.1%) −0.02 [−0.60, 0.56]
RE Model for All Studies (Q = 27.15, df = 12, p = 0.01; I² = 54.0%) 100.00% −0.94 [−1.31, −0.57]
−5
0
3
Hedge's G

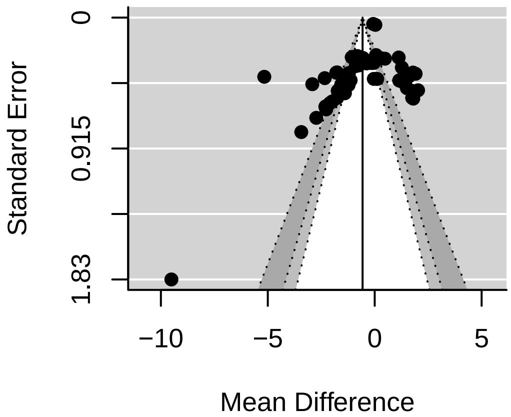

Standard Error
0
0.114
0.229
0.343
0.457
−1.5
−1
−0.5
0
0.5
1
1.5
Residual Value

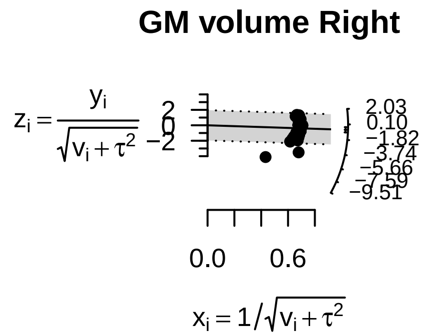

Influence on Fitted Value
0.000
0.002
0.004
0.006
Husain et al. B
Husain et al. Brain Res.1
Husain et al. Brain Res.2
ain et al. Brain Res.7
et al. Brain Res.5
al. Brain Res.4
0.000
0.005
0.010
0.015
0.020
Squared Pearson Residual

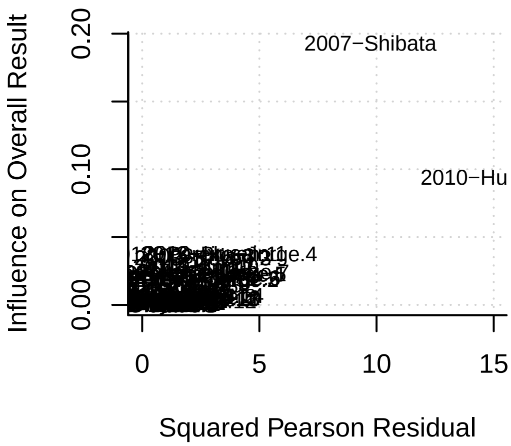

acquired White Matter FA
Sample Quantiles
−0.10
0.00
0.05
0.10
0.15
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Theoretical Quantiles

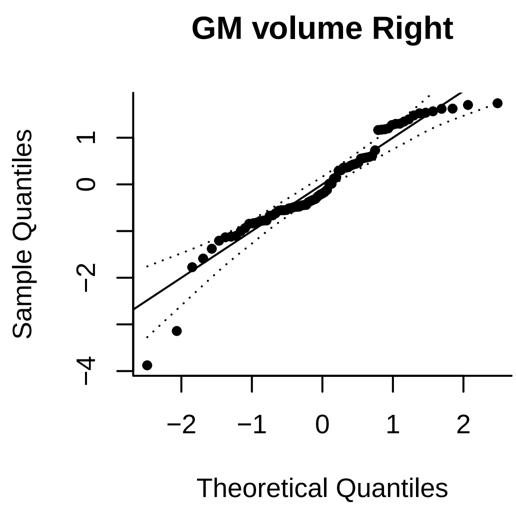
Supplementary material: heterogeneity per model

Heterogeney: GM volume Right

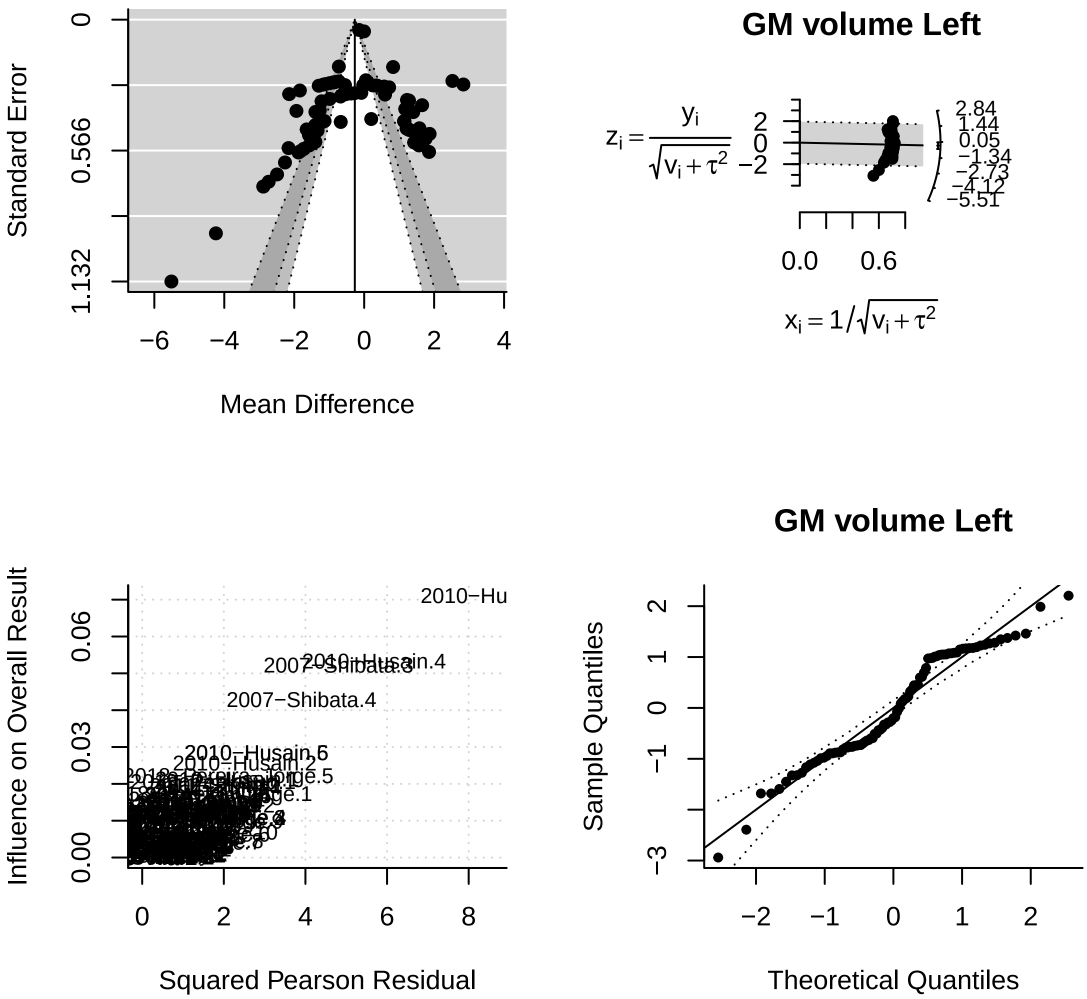




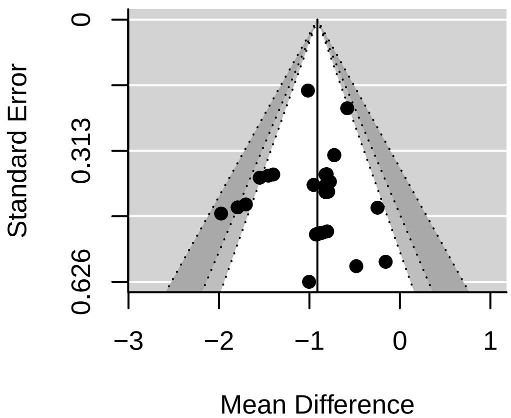


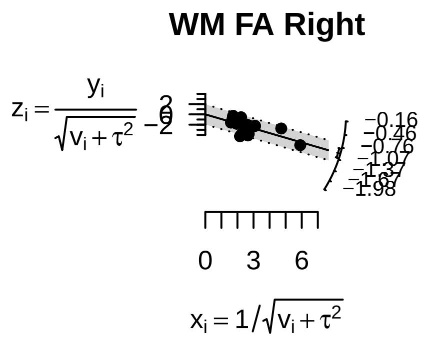


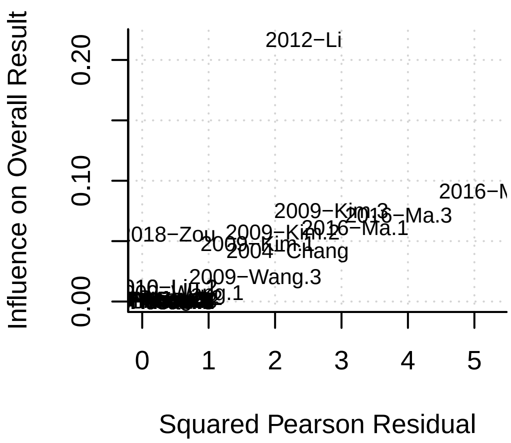
Heterogeney: GM volume Left

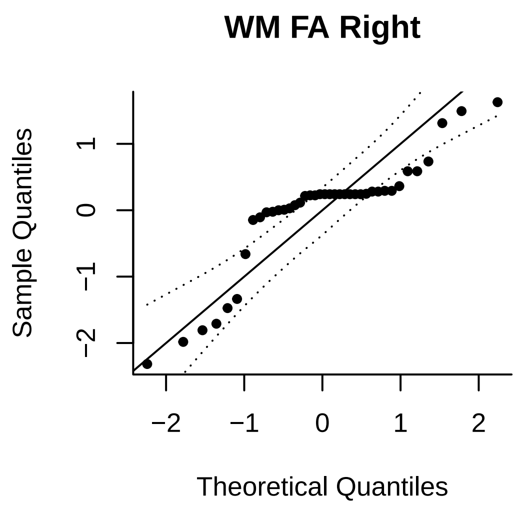


Heterogeney: WM FA Right

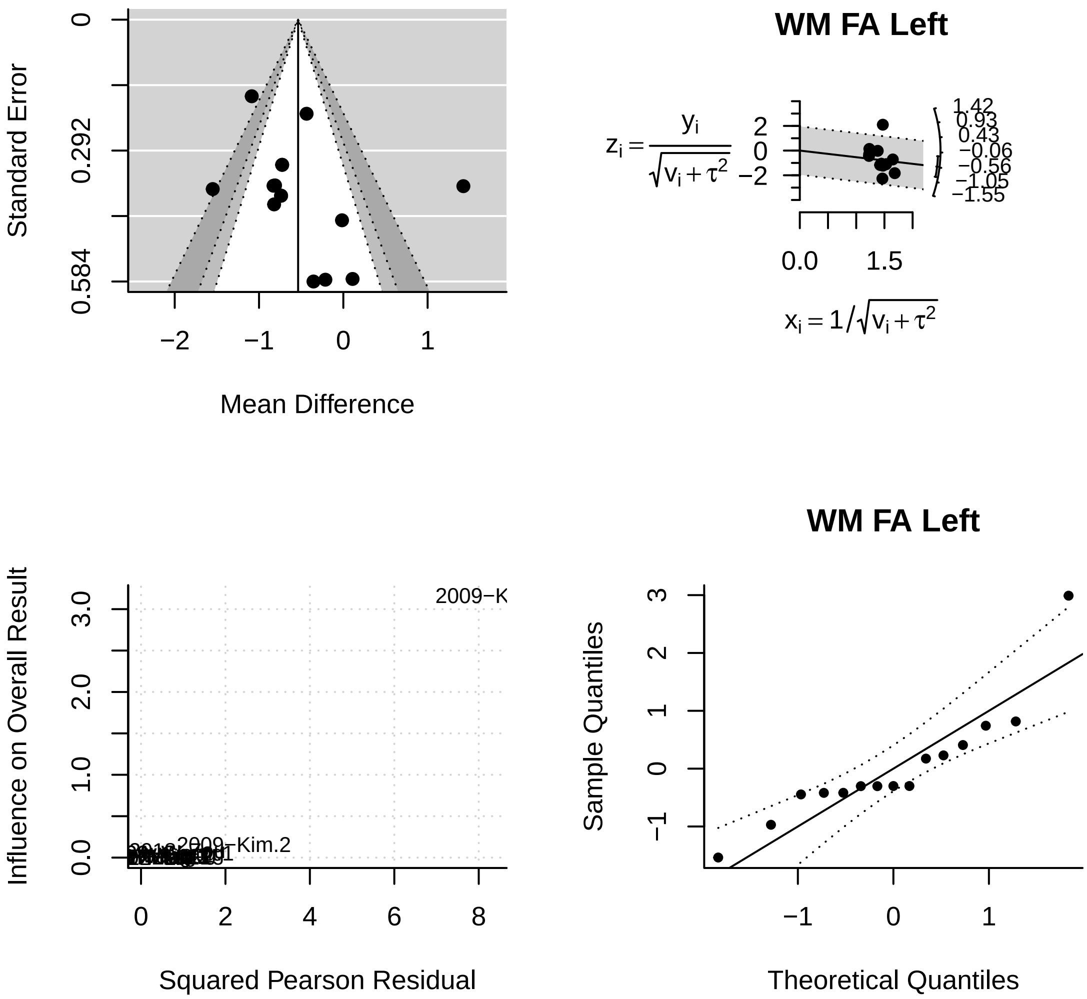




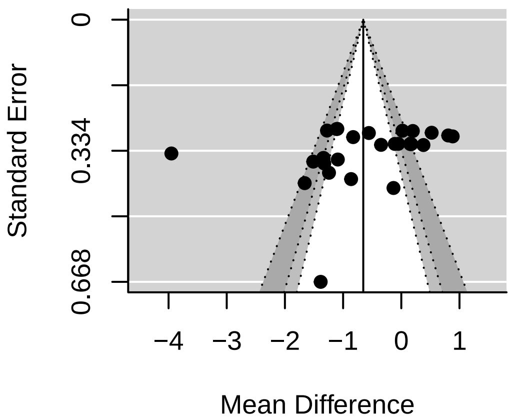


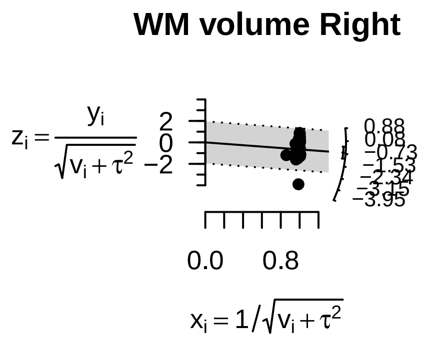


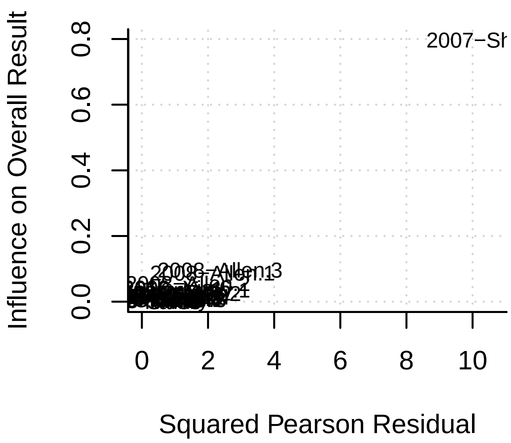
Heterogeney: WM FA Left

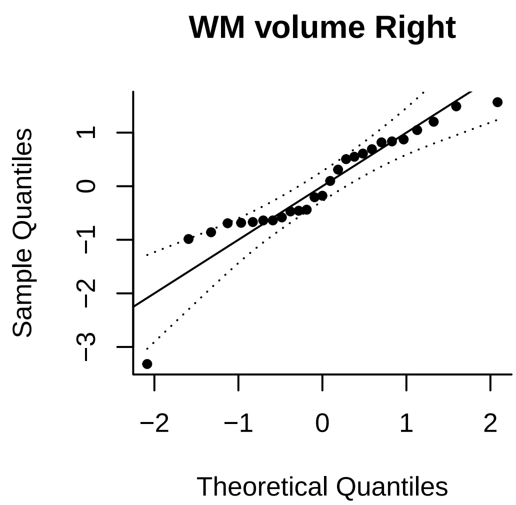


Heterogeney: WM volume Right









Heterogeney: WM volume Left

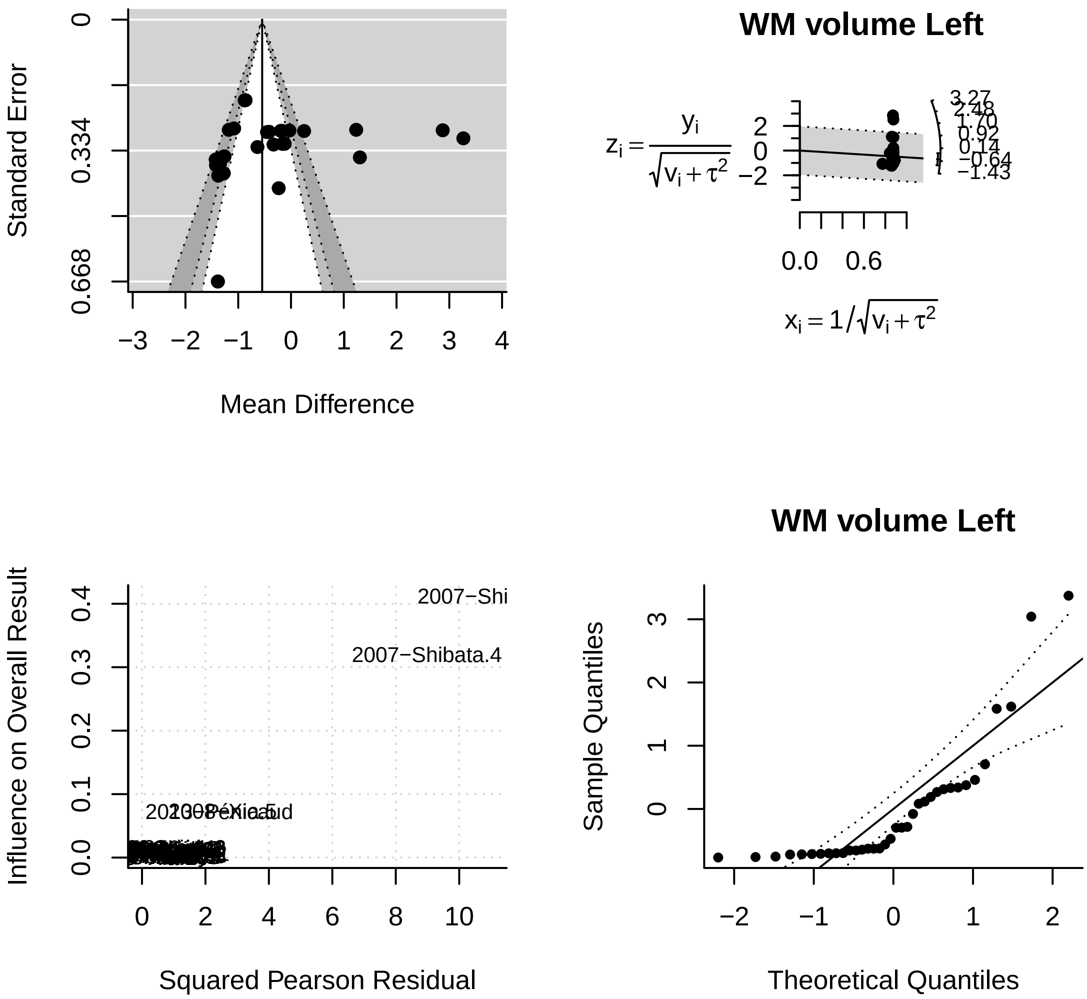
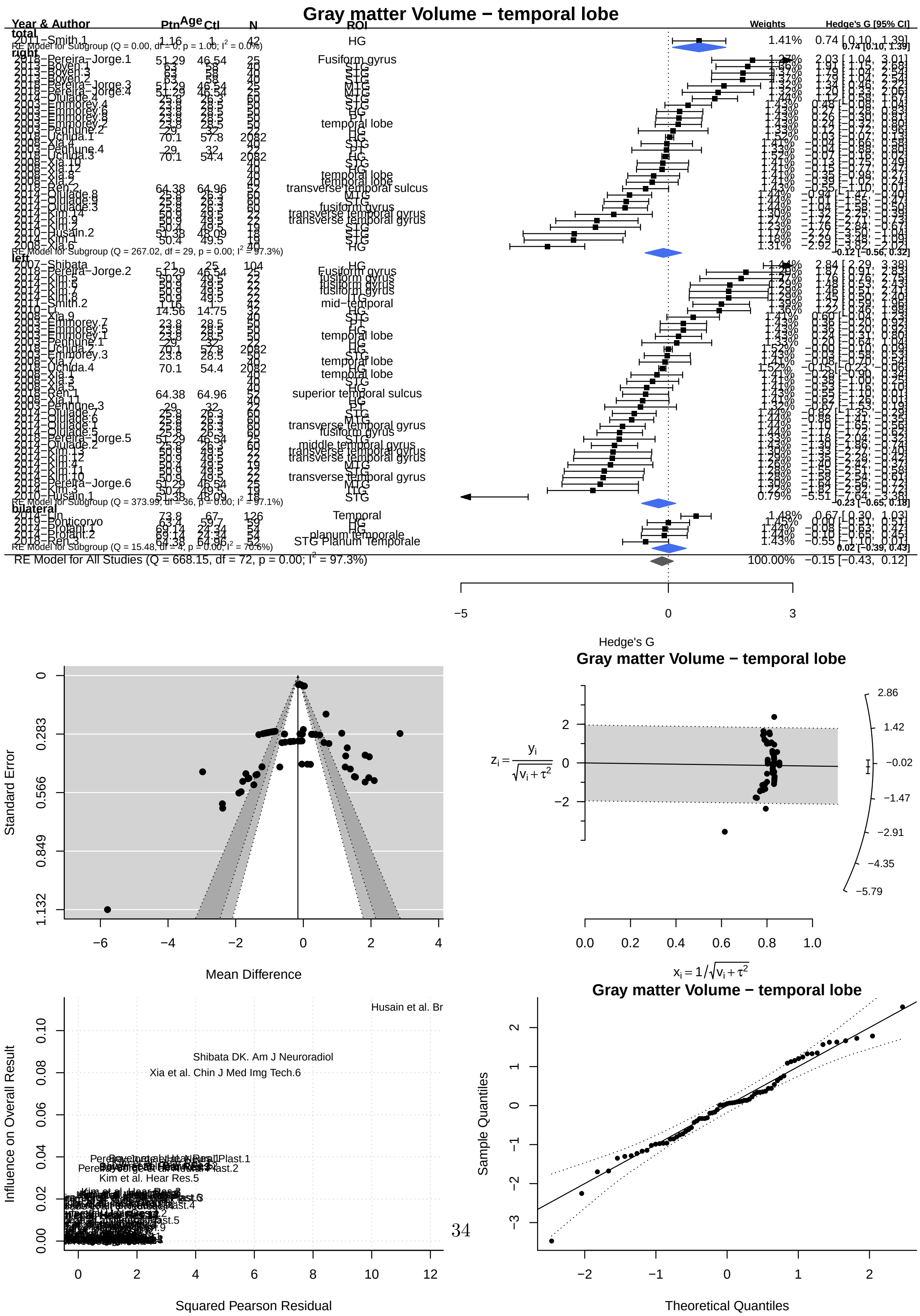
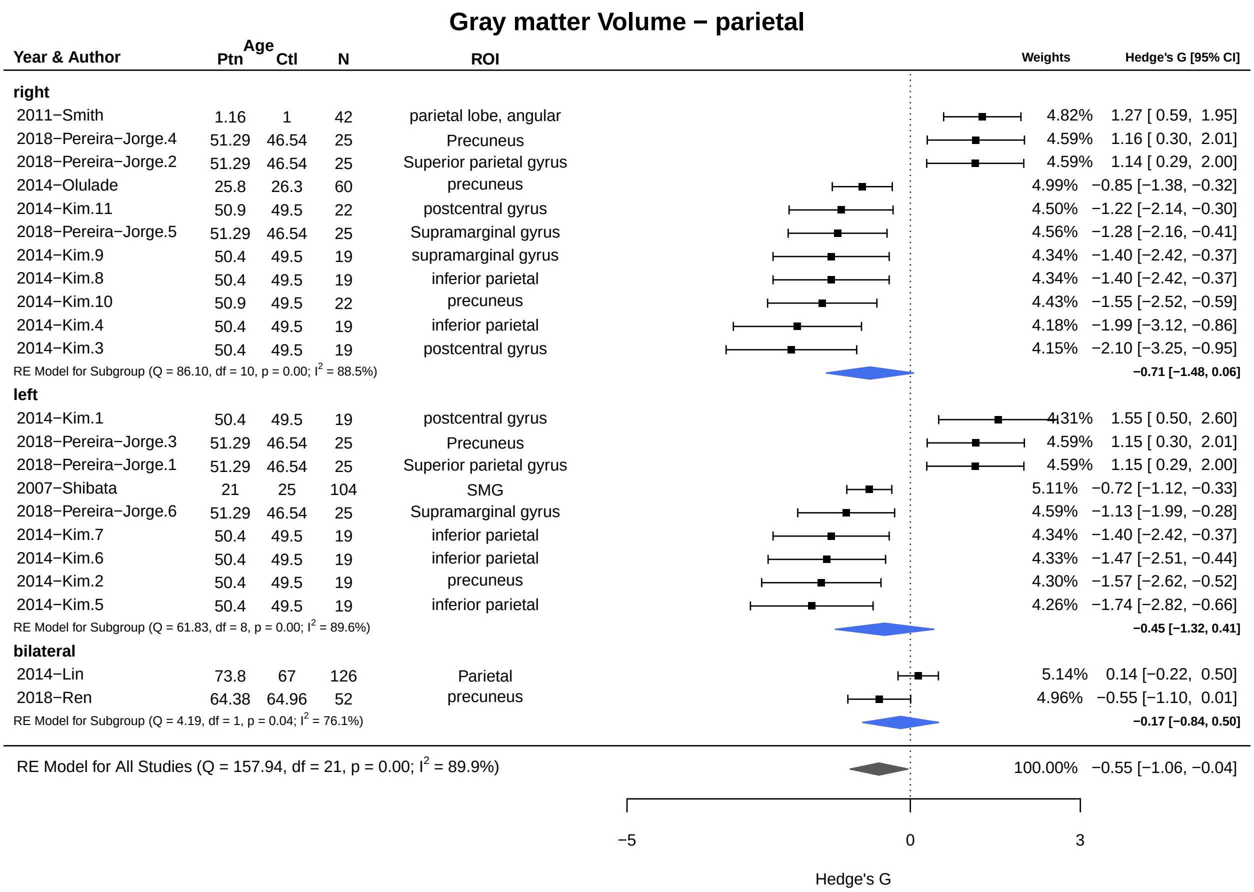
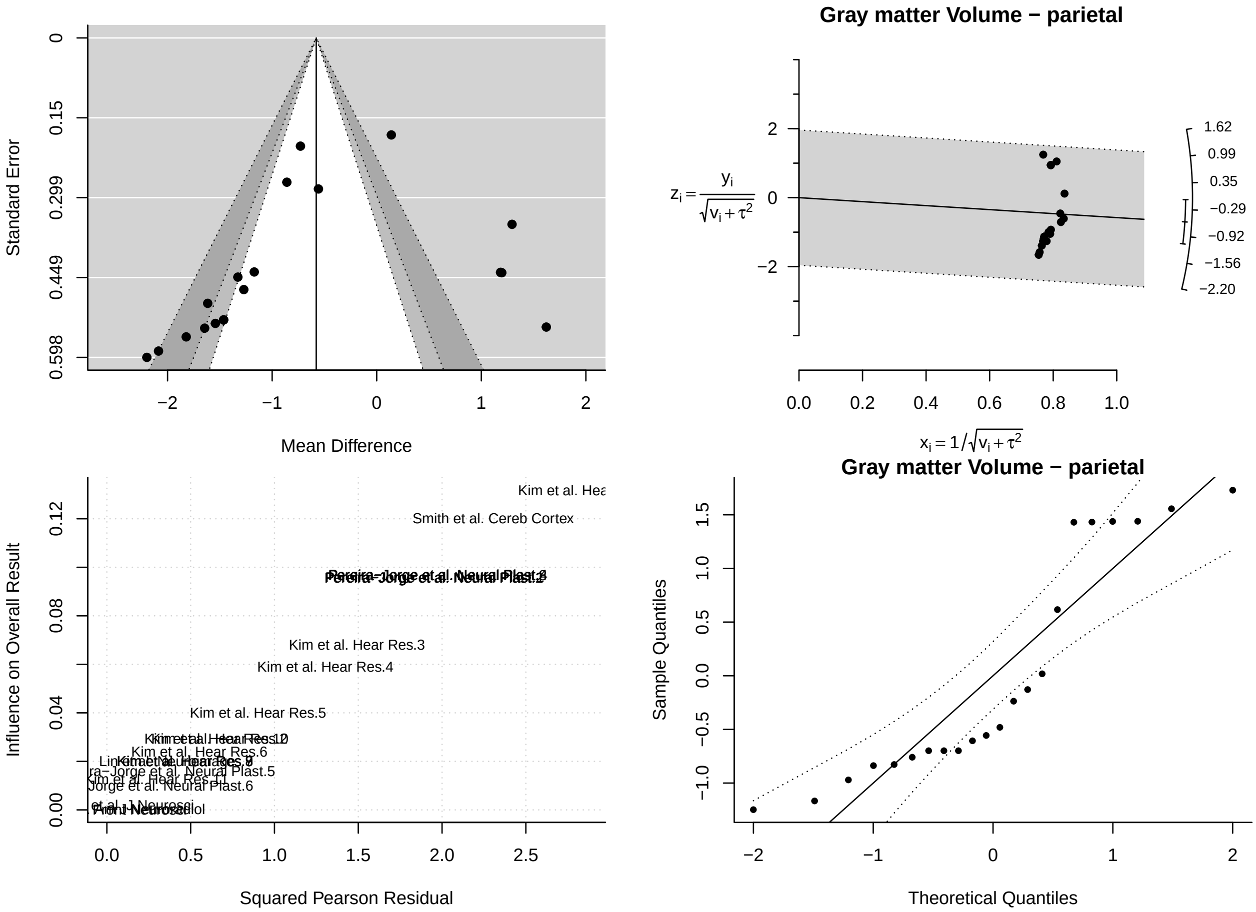


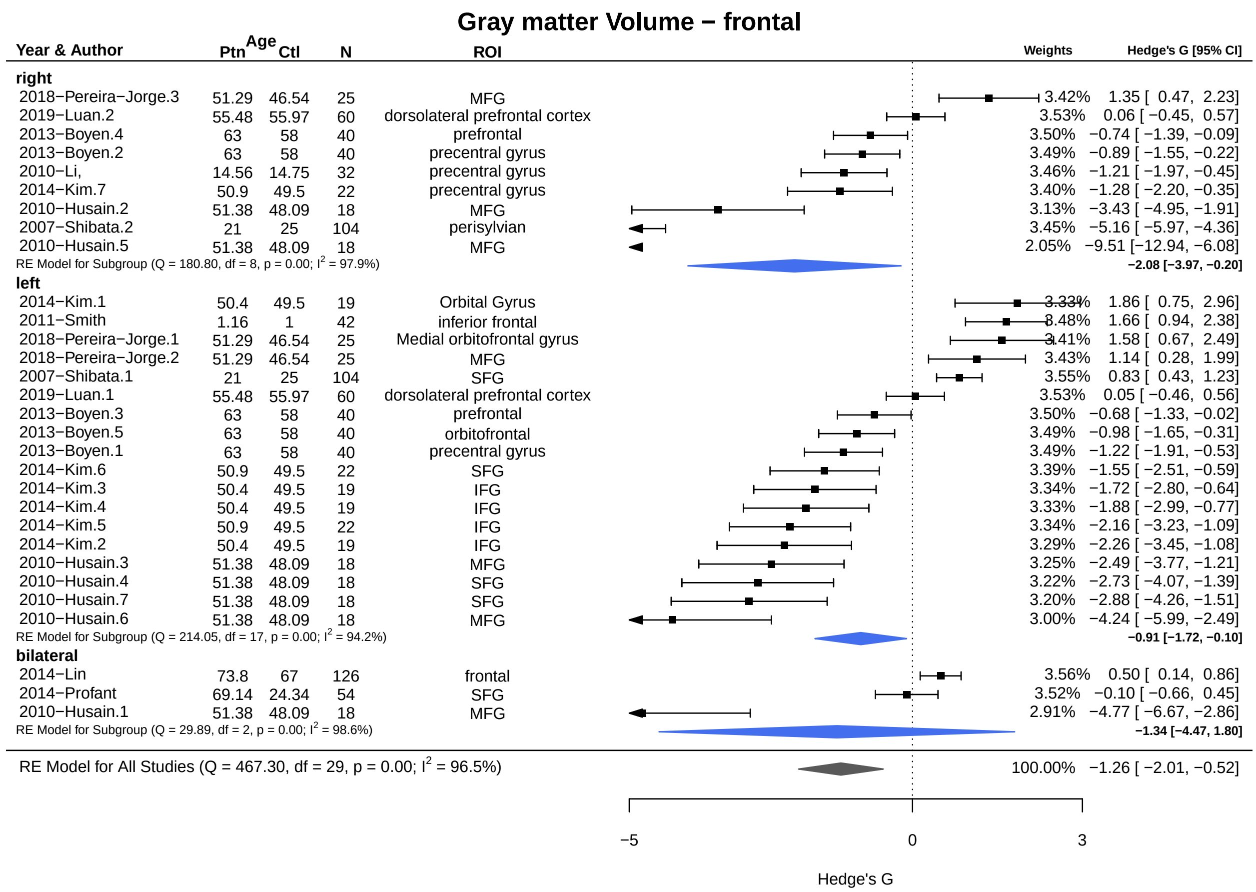
Figure 4 - Meta-regressions of Gray Matter Volume & Brain Areas: Random effects model no intercept covariated by Side

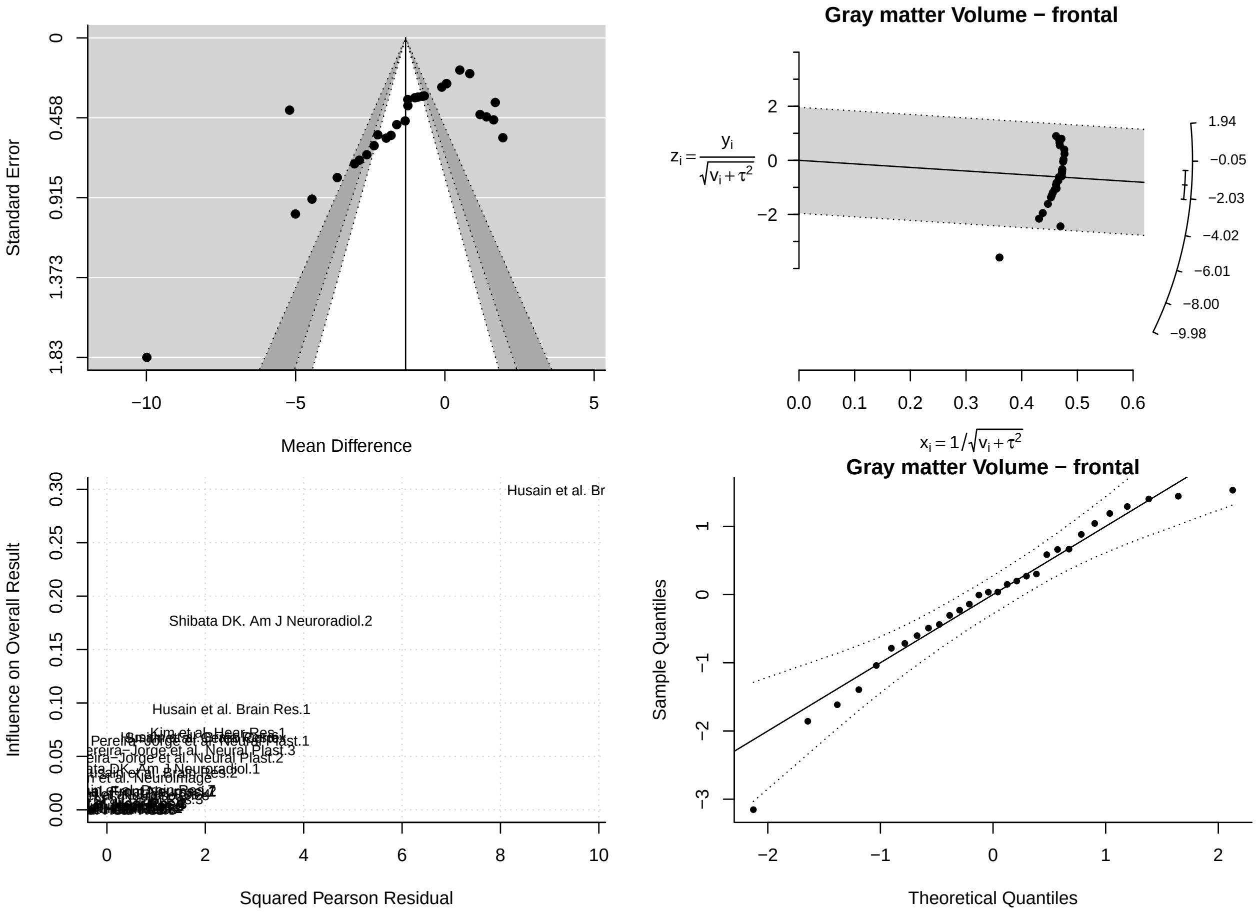



Gray matter Volume − parietal
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2011−Smith 1.16 1 42 parietal lobe, angular 4.82% 1.27 [0.59, 1.95]
2018−Pereira−Jorge.4 51.29 46.54 25 Precuneus 4.59% 1.16 [0.30, 2.01]
2018−Pereira−Jorge.2 51.29 46.54 25 Superior parietal gyrus 4.59% 1.14 [0.29, 2.00]
2014−Olulade 25.8 26.3 60 precuneus 4.99% −0.85 [−1.38, −0.32]
2014−Kim.11 50.9 49.5 22 postcentral gyrus 4.50% −1.22 [−2.14, −0.30]
2018−Pereira−Jorge.5 51.29 46.54 25 Supramarginal gyrus 4.56% −1.28 [−2.16, −0.41]
2014−Kim.9 50.4 49.5 19 supramarginal gyrus 4.34% −1.40 [−2.42, −0.37]
2014−Kim.8 50.4 49.5 19 inferior parietal 4.34% −1.40 [−2.42, −0.37]
2014−Kim.10 50.9 49.5 22 precuneus 4.43% −1.55 [−2.52, −0.59]
2014−Kim.4 50.4 49.5 19 inferior parietal 4.18% −1.99 [−3.12, −0.86]
2014−Kim.3 50.4 49.5 19 postcentral gyrus 4.15% −2.10 [−3.25, −0.95]
RE Model for Subgroup (Q = 86.10, df = 10, p = 0.00; I2 = 88.5%) −0.71 [−1.48, 0.06]
left
2014−Kim.1 50.4 49.5 19 postcentral gyrus 4.31% 1.55 [0.50, 2.60]
2018−Pereira−Jorge.3 51.29 46.54 25 Precuneus 4.59% 1.15 [0.30, 2.01]
2018−Pereira−Jorge.1 51.29 46.54 25 Superior parietal gyrus 4.59% 1.15 [0.29, 2.00]
2007−Shibata 21 25 104 SMG 5.11% −0.72 [−1.12, −0.33]
2018−Pereira−Jorge.6 51.29 46.54 25 Supramarginal gyrus 4.59% −1.13 [−1.99, −0.28]
2014−Kim.7 50.4 49.5 19 inferior parietal 4.34% −1.40 [−2.42, −0.37]
2014−Kim.6 50.4 49.5 19 inferior parietal 4.33% −1.47 [−2.51, −0.44]
2014−Kim.2 50.4 49.5 19 precuneus 4.30% −1.57 [−2.62, −0.52]
2014−Kim.5 50.4 49.5 19 inferior parietal 4.26% −1.74 [−2.82, −0.66]
RE Model for Subgroup (Q = 61.83, df = 8, p = 0.00; I2 = 89.6%) −0.45 [−1.32, 0.41]
bilateral
2014−Lin 73.8 67 126 Parietal 5.14% 0.14 [−0.22, 0.50]
2018−Ren 64.38 64.96 52 precuneus 4.96% −0.55 [−1.10, 0.01]
RE Model for Subgroup (Q = 4.19, df = 1, p = 0.04; I2 = 76.1%) −0.17 [−0.84, 0.50]
RE Model for All Studies (Q = 157.94, df = 21, p = 0.00; I2 = 89.9%) 100.00% −0.55 [−1.06, −0.04]
−5
0
3
Hedge's G

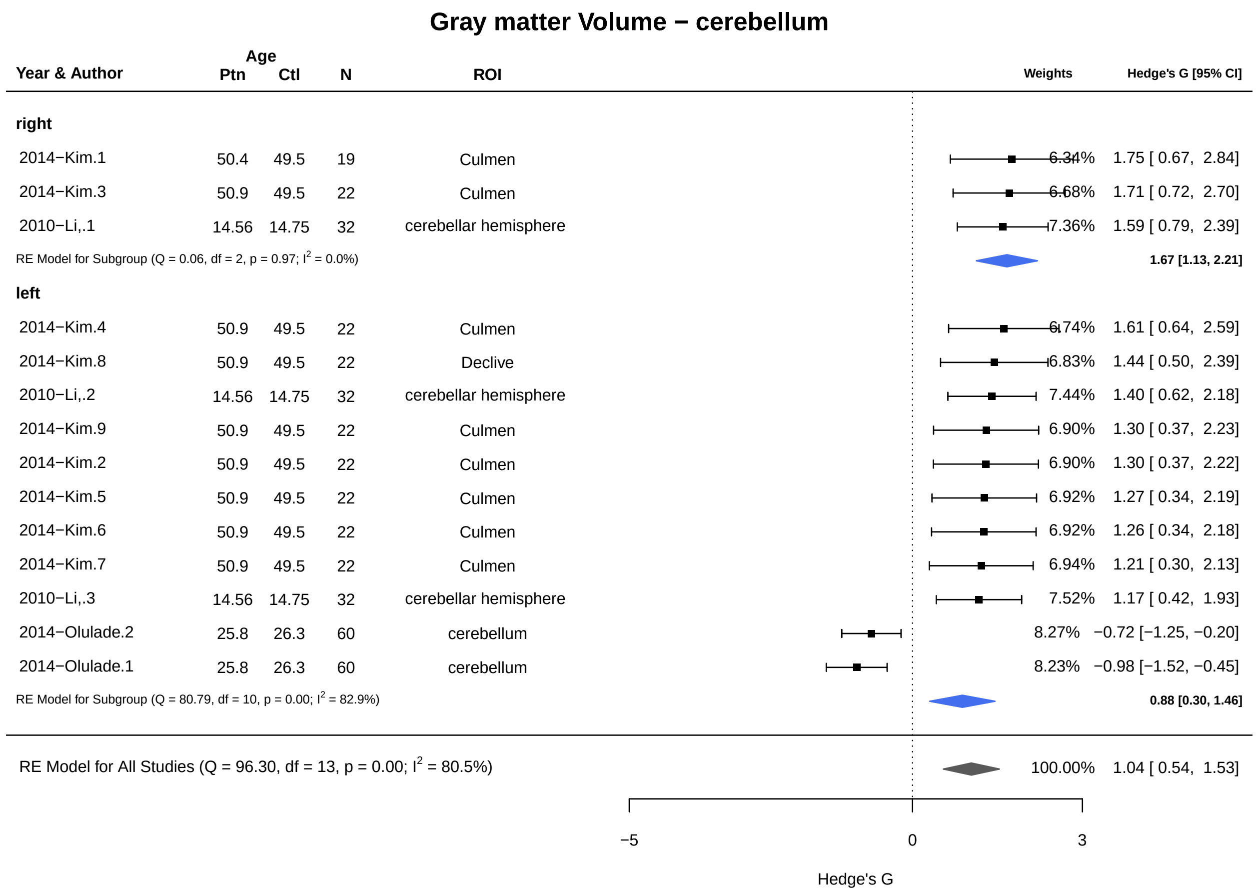


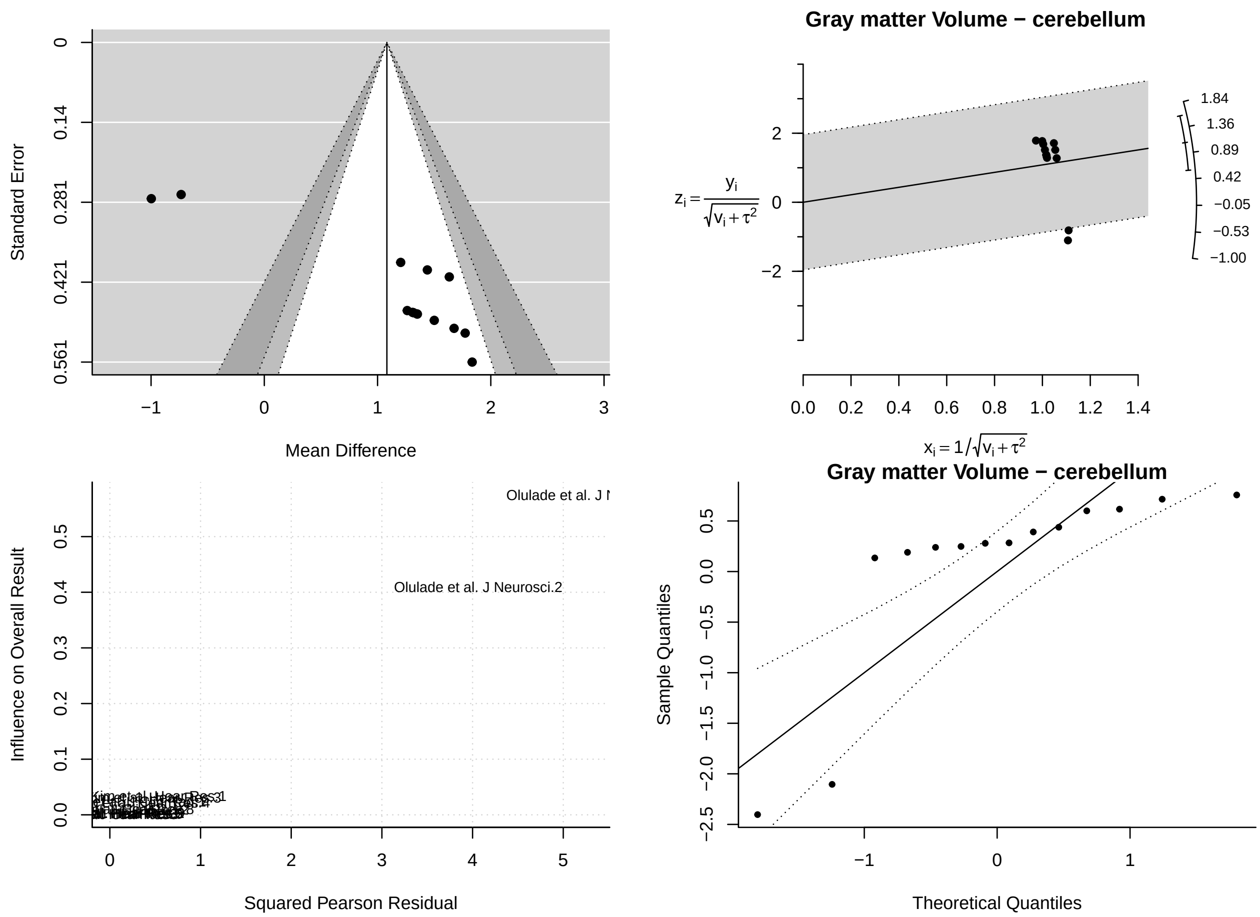
Standard Error
Mean Difference
Gray matter Volume − parietal
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
$x_i = 1/\sqrt{v_i + \tau^2}$
Influence on Overall Result
Squared Pearson Residual
Smith et al. Cereb Cortex
Kim et al. Hear Res.3
Kim et al. Hear Res.4
Kim et al. Hear Res.5
Kim et al. Hear Res.6
Gray matter Volume − parietal
Sample Quantiles
Theoretical Quantiles

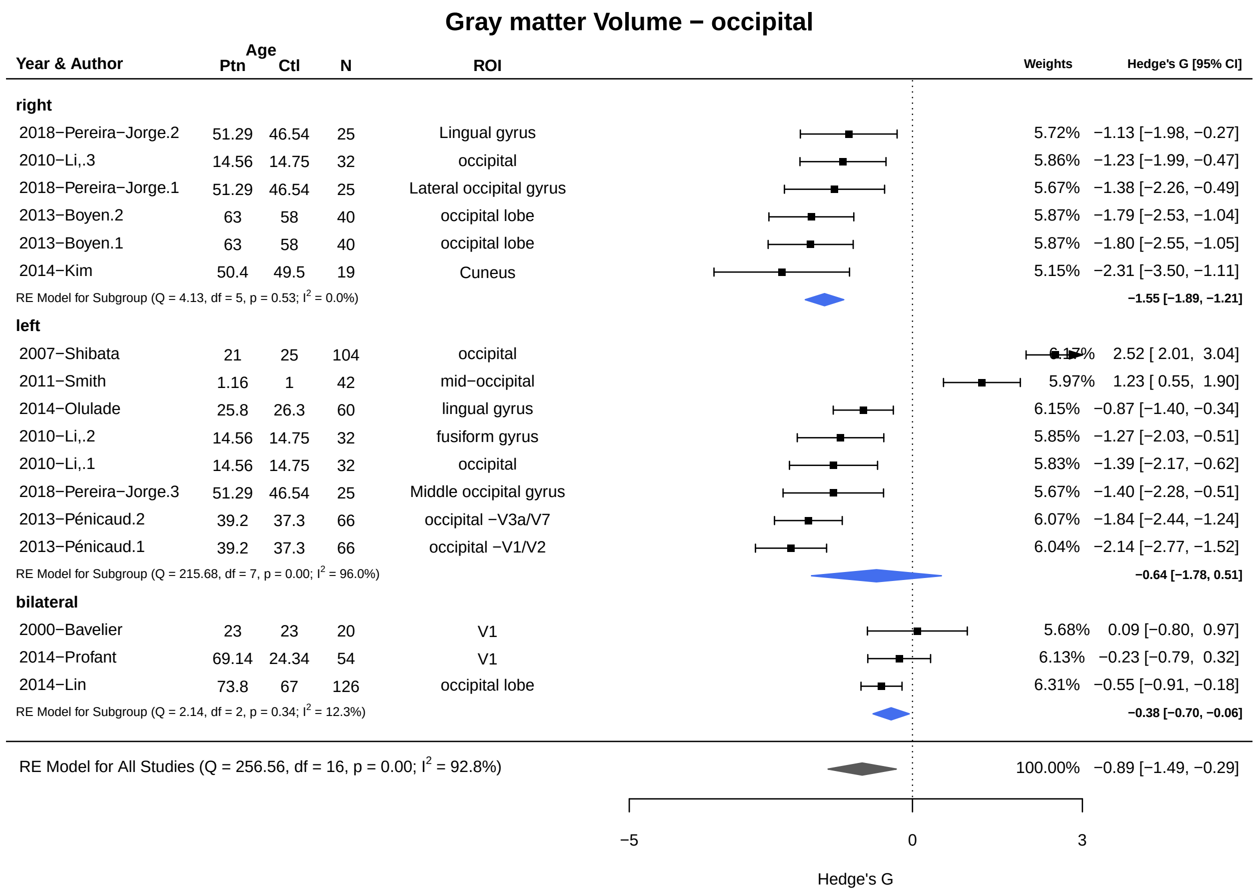

Gray matter Volume − frontal
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2018−Pereira−Jorge.3 51.29 46.54 25 MFG 3.42% 1.35 [0.47, 2.23]
2019−Luan.2 55.48 55.97 60 dorsolateral prefrontal cortex 3.53% 0.06 [−0.45, 0.57]
2013−Boyen.4 63 58 40 prefrontal 3.50% −0.74 [−1.39, −0.09]
2013−Boyen.2 63 58 40 precentral gyrus 3.49% −0.89 [−1.55, −0.22]
2010−Li, 14.56 14.75 32 precentral gyrus 3.46% −1.21 [−1.97, −0.45]
2014−Kim.7 50.9 49.5 22 precentral gyrus 3.40% −1.28 [−2.20, −0.35]
2010−Husain.2 51.38 48.09 18 MFG 3.13% −3.43 [−4.95, −1.91]
2007−Shibata.2 21 25 104 perisylvian 3.45% −5.16 [−5.97, −4.36]
2010−Husain.5 51.38 48.09 18 MFG 2.05% −9.51 [−12.94, −6.08]
RE Model for Subgroup (Q = 180.80, df = 8, p = 0.00; I² = 97.9%) −2.08 [−3.97, −0.20]
left
2014−Kim.1 50.4 49.5 19 Orbital Gyrus 3.33% 1.86 [0.75, 2.96]
2011−Smith 1.16 1 42 inferior frontal 3.48% 1.66 [0.94, 2.38]
2018−Pereira−Jorge.1 51.29 46.54 25 Medial orbitofrontal gyrus 3.41% 1.58 [0.67, 2.49]
2018−Pereira−Jorge.2 51.29 46.54 25 MFG 3.43% 1.14 [0.28, 1.99]
2007−Shibata.1 21 25 104 SFG 3.55% 0.83 [0.43, 1.23]
2019−Luan.1 55.48 55.97 60 dorsolateral prefrontal cortex 3.53% 0.05 [−0.46, 0.56]
2013−Boyen.3 63 58 40 prefrontal 3.50% −0.68 [−1.33, −0.02]
2013−Boyen.5 63 58 40 orbitofrontal 3.49% −0.98 [−1.65, −0.31]
2013−Boyen.1 63 58 40 precentral gyrus 3.49% −1.22 [−1.91, −0.53]
2014−Kim.6 50.9 49.5 22 SFG 3.39% −1.55 [−2.51, −0.59]
2014−Kim.3 50.4 49.5 19 IFG 3.34% −1.72 [−2.80, −0.64]
2014−Kim.4 50.4 49.5 19 IFG 3.33% −1.88 [−2.99, −0.77]
2014−Kim.5 50.9 49.5 22 IFG 3.34% −2.16 [−3.23, −1.09]
2014−Kim.2 50.4 49.5 19 IFG 3.29% −2.26 [−3.45, −1.08]
2010−Husain.3 51.38 48.09 18 MFG 3.25% −2.49 [−3.77, −1.21]
2010−Husain.4 51.38 48.09 18 SFG 3.22% −2.73 [−4.07, −1.39]
2010−Husain.7 51.38 48.09 18 SFG 3.20% −2.88 [−4.26, −1.51]
2010−Husain.6 51.38 48.09 18 MFG 3.00% −4.24 [−5.99, −2.49]
RE Model for Subgroup (Q = 214.05, df = 17, p = 0.00; I² = 94.2%) −0.91 [−1.72, −0.10]
bilateral
2014−Lin 73.8 67 126 frontal 3.56% 0.50 [0.14, 0.86]
2014−Profant 69.14 24.34 54 SFG 3.52% −0.10 [−0.66, 0.45]
2010−Husain.1 51.38 48.09 18 MFG 2.91% −4.77 [−6.67, −2.86]
RE Model for Subgroup (Q = 29.89, df = 2, p = 0.00; I² = 98.6%) −1.34 [−4.47, 1.80]
RE Model for All Studies (Q = 467.30, df = 29, p = 0.00; I² = 96.5%) 100.00% −1.26 [−2.01, −0.52]
−5
0
3
Hedge's G

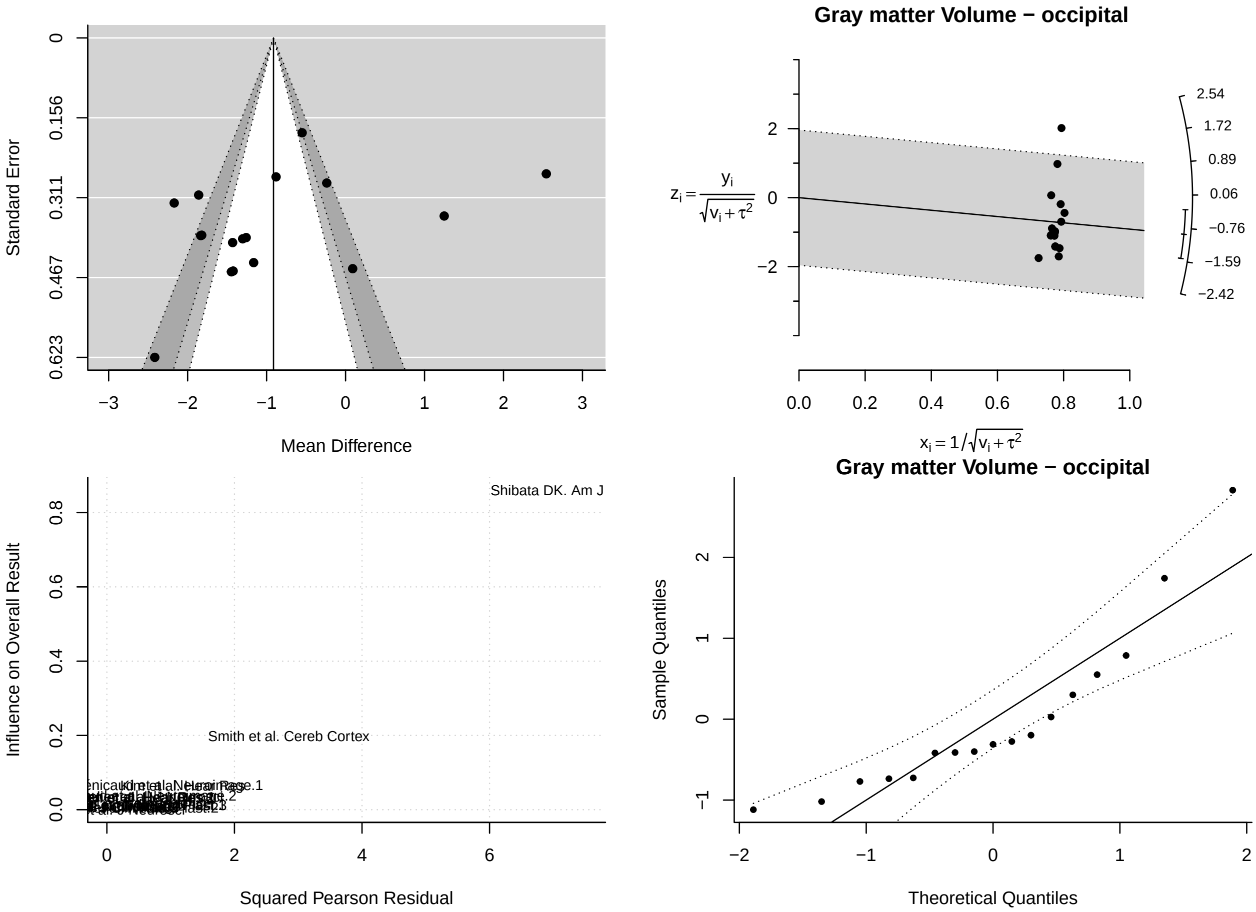


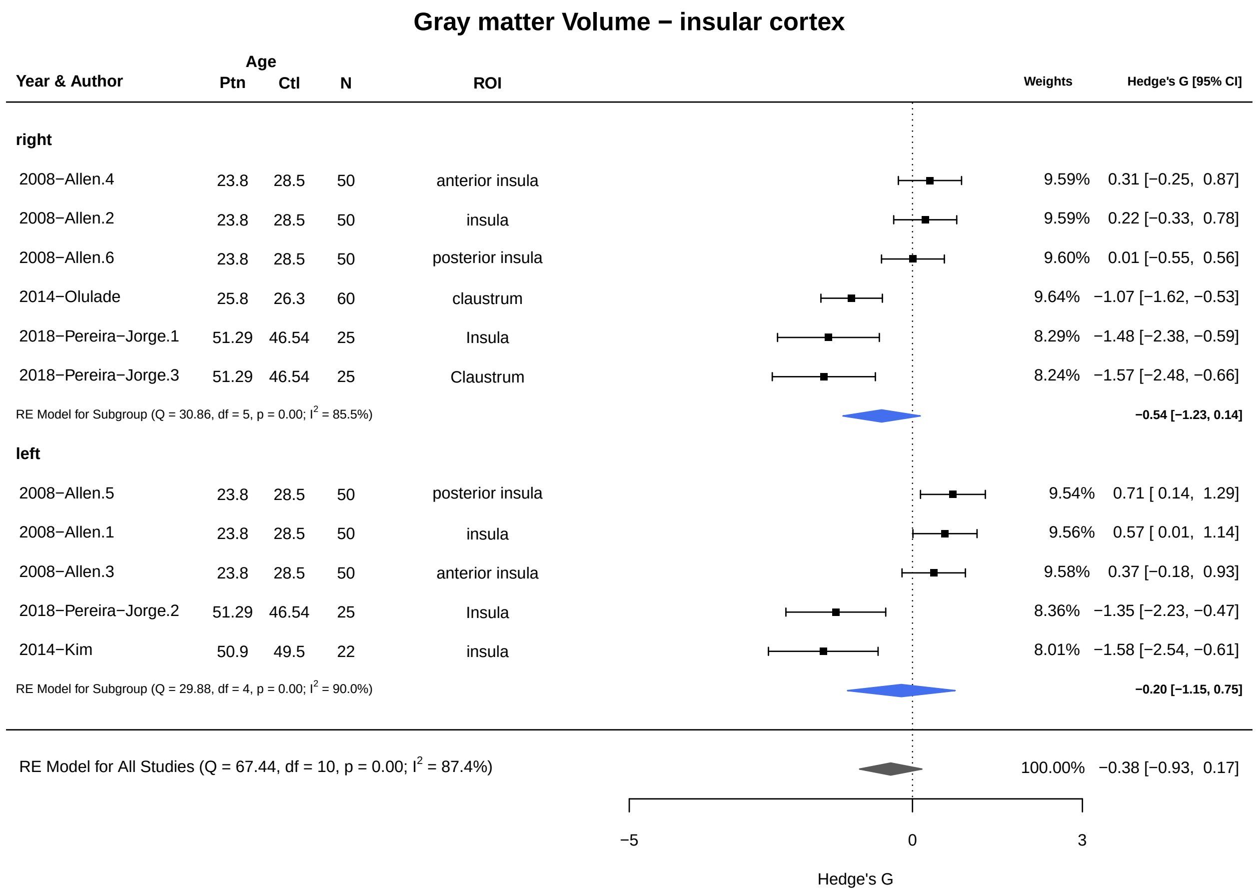
Standard Error
Mean Difference
Gray matter Volume − frontal
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
$x_i = 1/\sqrt{v_i + \tau^2}$
Influence on Overall Result
Squared Pearson Residual
Shibata DK. Am J Neuroradiol.2
Husain et al. Brain Res.1
Gray matter Volume − frontal
Sample Quantiles
Theoretical Quantiles

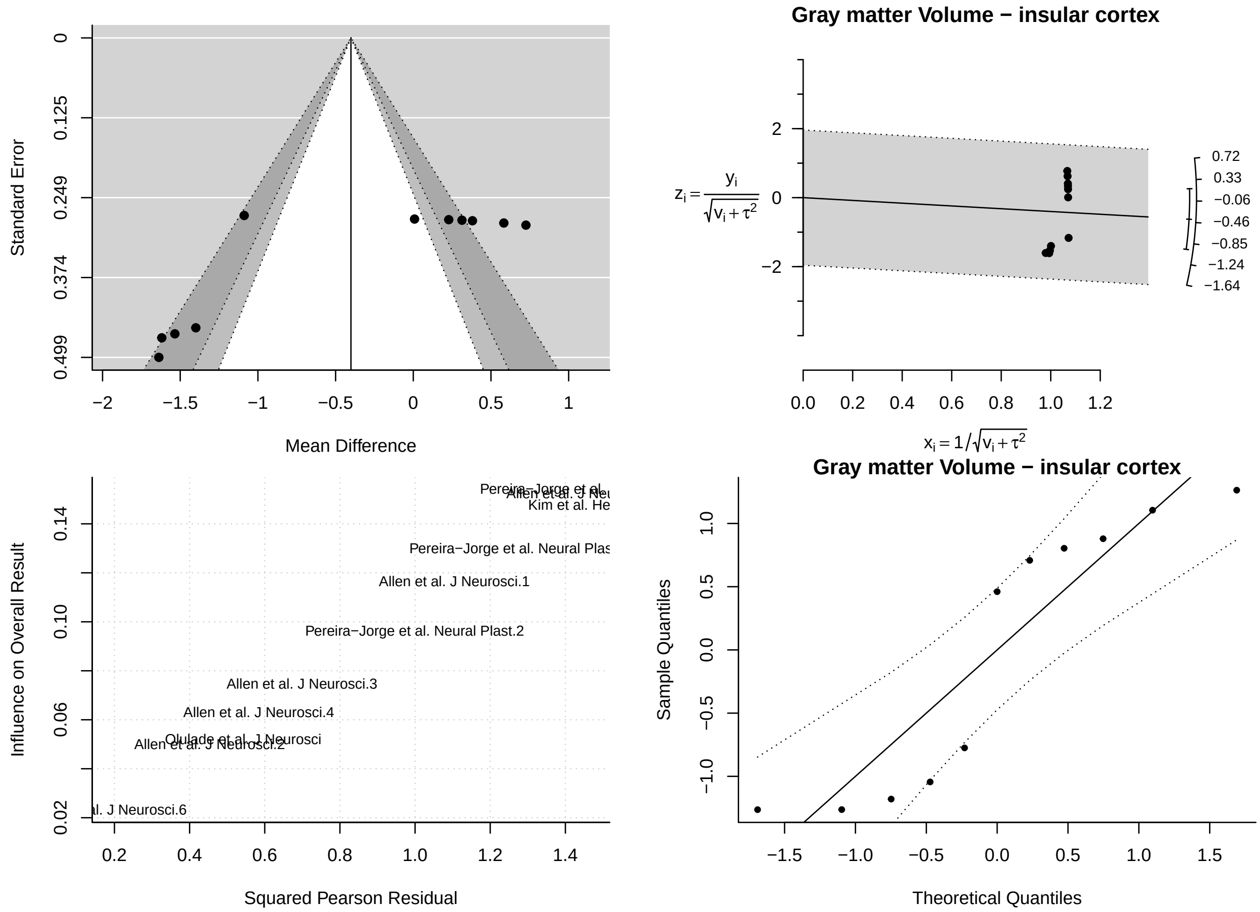

Gray matter Volume − cerebellum
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2014−Kim.1 50.4 49.5 19 Culmen 6.34% 1.75 [0.67, 2.84]
2014−Kim.3 50.9 49.5 22 Culmen 6.68% 1.71 [0.72, 2.70]
2010−Li,.1 14.56 14.75 32 cerebellar hemisphere 7.36% 1.59 [0.79, 2.39]
RE Model for Subgroup (Q = 0.06, df = 2, p = 0.97; I2 = 0.0%) 1.67 [1.13, 2.21]
left
2014−Kim.4 50.9 49.5 22 Culmen 6.74% 1.61 [0.64, 2.59]
2014−Kim.8 50.9 49.5 22 Declive 6.83% 1.44 [0.50, 2.39]
2010−Li,.2 14.56 14.75 32 cerebellar hemisphere 7.44% 1.40 [0.62, 2.18]
2014−Kim.9 50.9 49.5 22 Culmen 6.90% 1.30 [0.37, 2.23]
2014−Kim.2 50.9 49.5 22 Culmen 6.90% 1.30 [0.37, 2.22]
2014−Kim.5 50.9 49.5 22 Culmen 6.92% 1.27 [0.34, 2.19]
2014−Kim.6 50.9 49.5 22 Culmen 6.92% 1.26 [0.34, 2.18]
2014−Kim.7 50.9 49.5 22 Culmen 6.94% 1.21 [0.30, 2.13]
2010−Li,.3 14.56 14.75 32 cerebellar hemisphere 7.52% 1.17 [0.42, 1.93]
2014−Olulade.2 25.8 26.3 60 cerebellum 8.27% −0.72 [−1.25, −0.20]
2014−Olulade.1 25.8 26.3 60 cerebellum 8.23% −0.98 [−1.52, −0.45]
RE Model for Subgroup (Q = 80.79, df = 10, p = 0.00; I2 = 82.9%) 0.88 [0.30, 1.46]
RE Model for All Studies (Q = 96.30, df = 13, p = 0.00; I2 = 80.5%) 100.00% 1.04 [0.54, 1.53]
−5
0
3
Hedge's G


Standard Error
Mean Difference
Gray matter Volume − cerebellum
Influence on Overall Result
Squared Pearson Residual
Olulade et al. J Neurosci.2
Gray matter Volume − cerebellum
Sample Quantiles
Theoretical Quantiles


Gray matter Volume − occipital
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2018−Pereira−Jorge.2 51.29 46.54 25 Lingual gyrus 5.72% −1.13 [−1.98, −0.27]
2010−Li,.3 14.56 14.75 32 occipital 5.86% −1.23 [−1.99, −0.47]
2018−Pereira−Jorge.1 51.29 46.54 25 Lateral occipital gyrus 5.67% −1.38 [−2.26, −0.49]
2013−Boyen.2 63 58 40 occipital lobe 5.87% −1.79 [−2.53, −1.04]
2013−Boyen.1 63 58 40 occipital lobe 5.87% −1.80 [−2.55, −1.05]
2014−Kim 50.4 49.5 19 Cuneus 5.15% −2.31 [−3.50, −1.11]
RE Model for Subgroup (Q = 4.13, df = 5, p = 0.53; I2 = 0.0%) −1.55 [−1.89, −1.21]
left
2007−Shibata 21 25 104 occipital 6.17% 2.52 [2.01, 3.04]
2011−Smith 1.16 1 42 mid−occipital 5.97% 1.23 [0.55, 1.90]
2014−Olulade 25.8 26.3 60 lingual gyrus 6.15% −0.87 [−1.40, −0.34]
2010−Li,.2 14.56 14.75 32 fusiform gyrus 5.85% −1.27 [−2.03, −0.51]
2010−Li,.1 14.56 14.75 32 occipital 5.83% −1.39 [−2.17, −0.62]
2018−Pereira−Jorge.3 51.29 46.54 25 Middle occipital gyrus 5.67% −1.40 [−2.28, −0.51]
2013−Pénicaud.2 39.2 37.3 66 occipital −V3a/V7 6.07% −1.84 [−2.44, −1.24]
2013−Pénicaud.1 39.2 37.3 66 occipital −V1/V2 6.04% −2.14 [−2.77, −1.52]
RE Model for Subgroup (Q = 215.68, df = 7, p = 0.00; I2 = 96.0%) −0.64 [−1.78, 0.51]
bilateral
2000−Bavelier 23 23 20 V1 5.68% 0.09 [−0.80, 0.97]
2014−Profant 69.14 24.34 54 V1 6.13% −0.23 [−0.79, 0.32]
2014−Lin 73.8 67 126 occipital lobe 6.31% −0.55 [−0.91, −0.18]
RE Model for Subgroup (Q = 2.14, df = 2, p = 0.34; I2 = 12.3%) −0.38 [−0.70, −0.06]
RE Model for All Studies (Q = 256.56, df = 16, p = 0.00; I2 = 92.8%) 100.00% −0.89 [−1.49, −0.29]
−5
0
3
Hedge's G

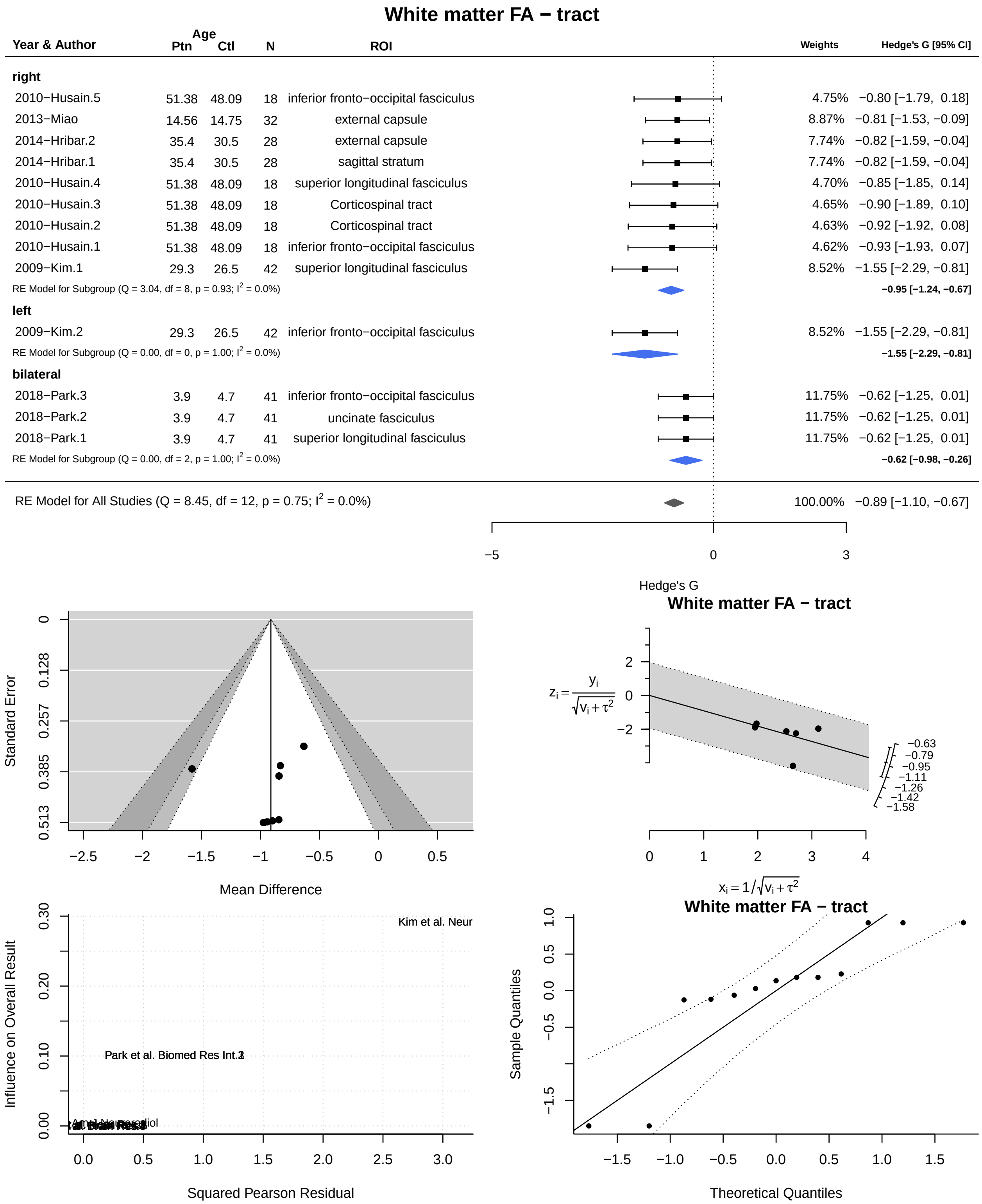

Standard Error
0
0.156
0.311
0.467
0.623
−3
−2
−1
0
1
2
3
Mean Difference
Gray matter Volume − occipital
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
2
0
−2
2.54
1.72
0.89
0.06
−0.76
−1.59
−2.42
0.0
0.2
0.4
0.6
0.8
1.0
$x_i = 1/\sqrt{v_i + \tau^2}$
Influence on Overall Result
0.0
0.2
0.4
0.6
0.8
Shibata DK. Am J
Smith et al. Cereb Cortex
Squared Pearson Residual
0
2
4
6
Gray matter Volume − occipital
Sample Quantiles
−1
0
1
2
−2
−1
0
1
2
Theoretical Quantiles

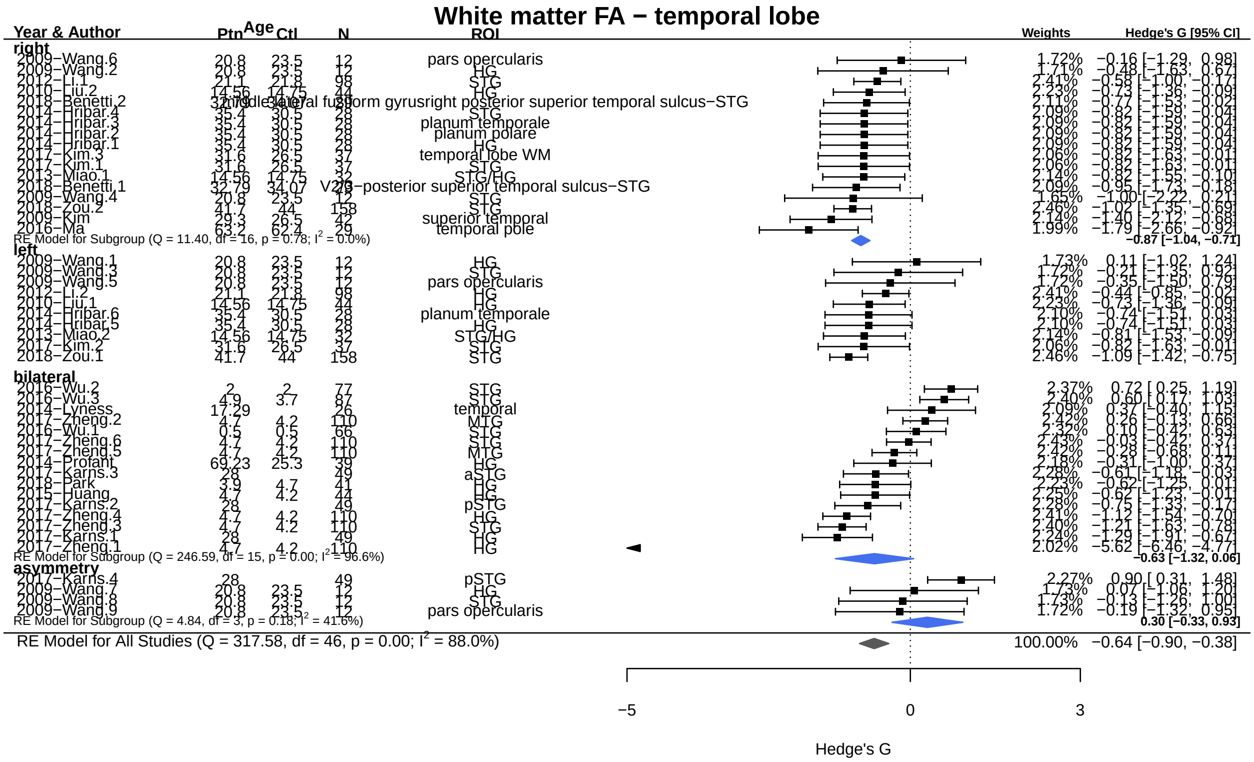

Gray matter Volume − insular cortex
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2008−Allen.4 23.8 28.5 50 anterior insula 9.59% 0.31 [−0.25, 0.87]
2008−Allen.2 23.8 28.5 50 insula 9.59% 0.22 [−0.33, 0.78]
2008−Allen.6 23.8 28.5 50 posterior insula 9.60% 0.01 [−0.55, 0.56]
2014−Olulade 25.8 26.3 60 claustrum 9.64% −1.07 [−1.62, −0.53]
2018−Pereira−Jorge.1 51.29 46.54 25 Insula 8.29% −1.48 [−2.38, −0.59]
2018−Pereira−Jorge.3 51.29 46.54 25 Claustrum 8.24% −1.57 [−2.48, −0.66]
RE Model for Subgroup (Q = 30.86, df = 5, p = 0.00; I2 = 85.5%) −0.54 [−1.23, 0.14]
left
2008−Allen.5 23.8 28.5 50 posterior insula 9.54% 0.71 [0.14, 1.29]
2008−Allen.1 23.8 28.5 50 insula 9.56% 0.57 [0.01, 1.14]
2008−Allen.3 23.8 28.5 50 anterior insula 9.58% 0.37 [−0.18, 0.93]
2018−Pereira−Jorge.2 51.29 46.54 25 Insula 8.36% −1.35 [−2.23, −0.47]
2014−Kim 50.9 49.5 22 insula 8.01% −1.58 [−2.54, −0.61]
RE Model for Subgroup (Q = 29.88, df = 4, p = 0.00; I2 = 90.0%) −0.20 [−1.15, 0.75]
RE Model for All Studies (Q = 67.44, df = 10, p = 0.00; I2 = 87.4%) 100.00% −0.38 [−0.93, 0.17]
−5
0
3
Hedge's G



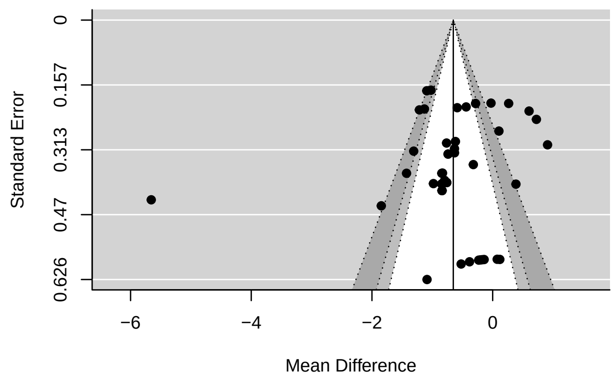
Standard Error
Mean Difference
Gray matter Volume − insular cortex
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
$x_i = 1/\sqrt{v_i + \tau^2}$
0.72
0.33
−0.06
−0.46
−0.85
−1.24
−1.64
Influence on Overall Result
Squared Pearson Residual
Pereira−Jorge et al. Neural Plast.2
Allen et al. J Neurosci.1
Allen et al. J Neurosci.3
Allen et al. J Neurosci.4
Allen et al. J Neurosci.2
Gray matter Volume − insular cortex
Sample Quantiles
Theoretical Quantiles

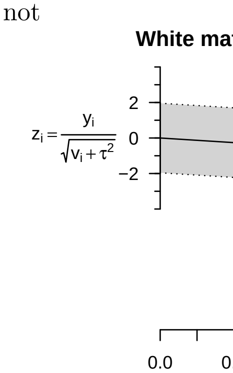
Figure 5 - Meta-regressions of White Matter FA & Brain Areas: Random effects model no intercept covariated by Side

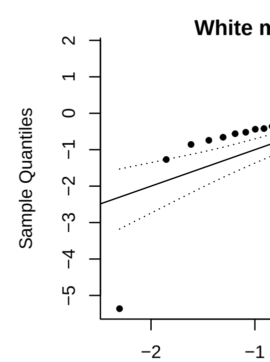




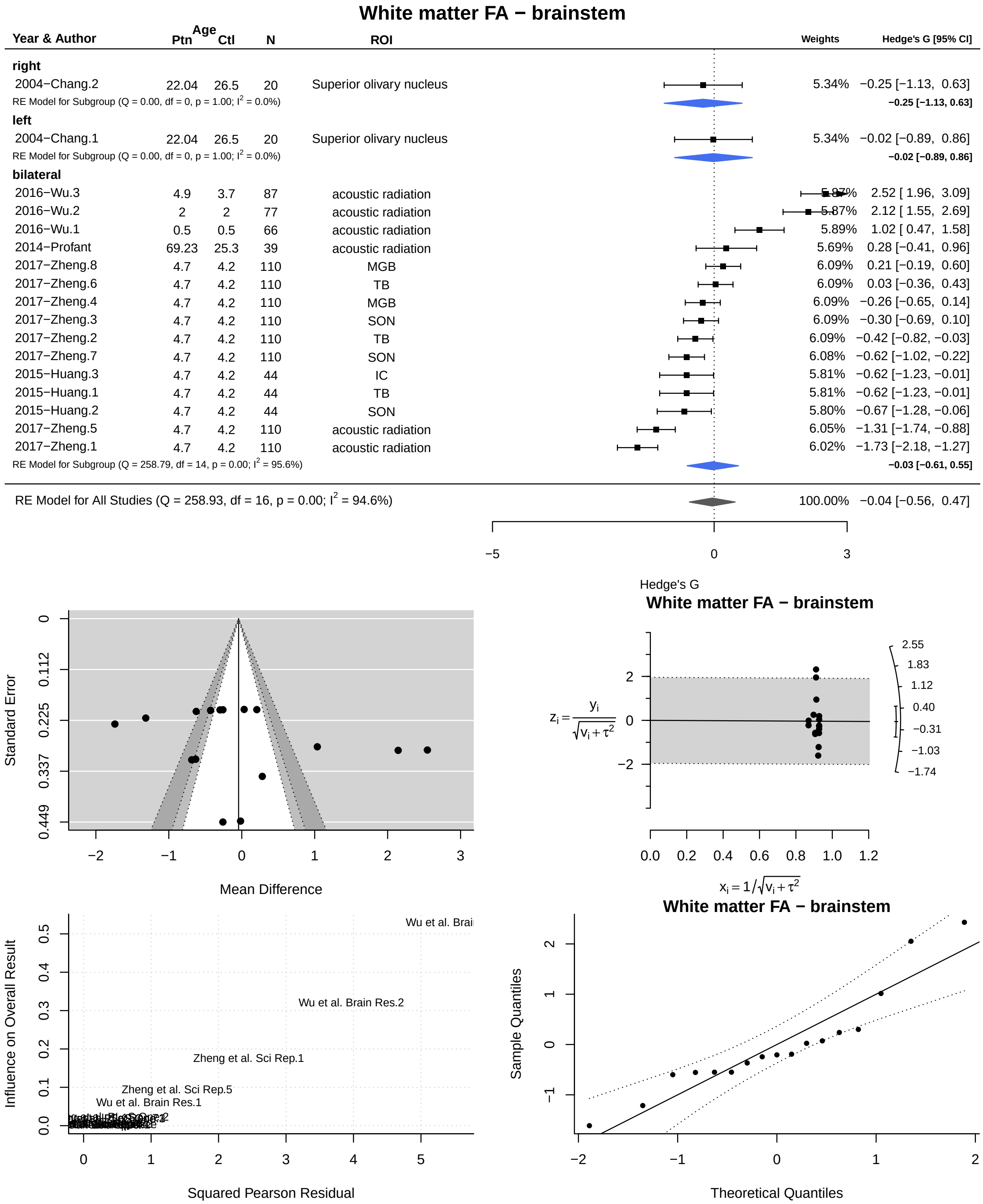
Error in rma(yi = hedgesG, vi = varG, data = meta.mod, measure = “MD”, : Fisher scoring algorithm did not

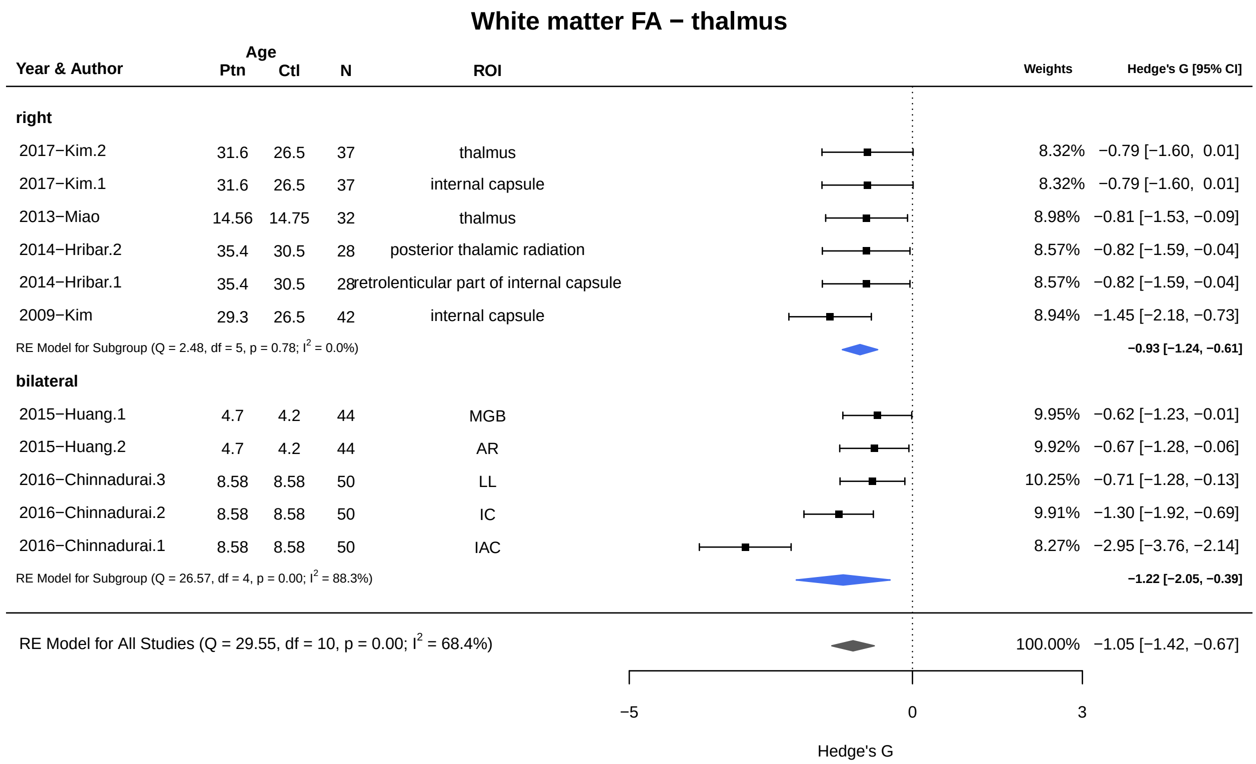


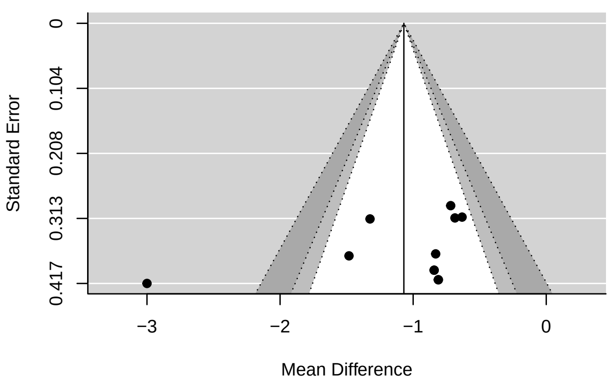


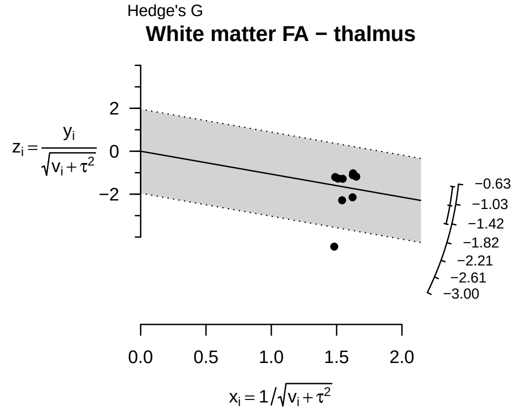


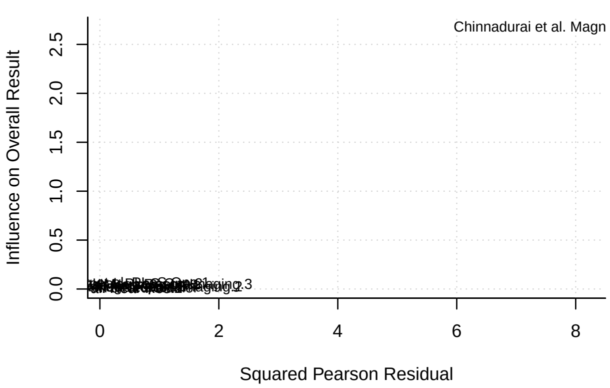
converge. See ‘help(rma)’ for possible remedies.

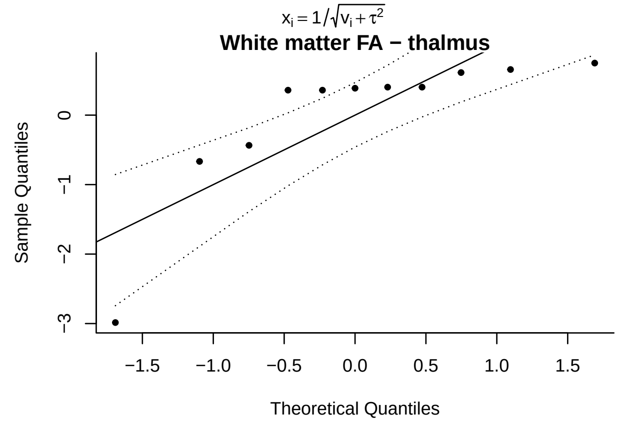

White matter FA − brainstem
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2004−Chang.2 22.04 26.5 20 Superior olivary nucleus 5.34% −0.25 [−1.13, 0.63]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.25 [−1.13, 0.63]
left
2004−Chang.1 22.04 26.5 20 Superior olivary nucleus 5.34% −0.02 [−0.89, 0.86]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.02 [−0.89, 0.86]
bilateral
2016−Wu.3 4.9 3.7 87 acoustic radiation 5.87% 2.52 [1.96, 3.09]
2016−Wu.2 2 2 77 acoustic radiation 5.87% 2.12 [1.55, 2.69]
2016−Wu.1 0.5 0.5 66 acoustic radiation 5.89% 1.02 [0.47, 1.58]
2014−Profant 69.23 25.3 39 acoustic radiation 5.69% 0.28 [−0.41, 0.96]
2017−Zheng.8 4.7 4.2 110 MGB 6.09% 0.21 [−0.19, 0.60]
2017−Zheng.6 4.7 4.2 110 TB 6.09% 0.03 [−0.36, 0.43]
2017−Zheng.4 4.7 4.2 110 MGB 6.09% −0.26 [−0.65, 0.14]
2017−Zheng.3 4.7 4.2 110 SON 6.09% −0.30 [−0.69, 0.10]
2017−Zheng.2 4.7 4.2 110 TB 6.09% −0.42 [−0.82, −0.03]
2017−Zheng.7 4.7 4.2 110 SON 6.08% −0.62 [−1.02, −0.22]
2015−Huang.3 4.7 4.2 44 IC 5.81% −0.62 [−1.23, −0.01]
2015−Huang.1 4.7 4.2 44 TB 5.81% −0.62 [−1.23, −0.01]
2015−Huang.2 4.7 4.2 44 SON 5.80% −0.67 [−1.28, −0.06]
2017−Zheng.5 4.7 4.2 110 acoustic radiation 6.05% −1.31 [−1.74, −0.88]
2017−Zheng.1 4.7 4.2 110 acoustic radiation 6.02% −1.73 [−2.18, −1.27]
RE Model for Subgroup (Q = 258.79, df = 14, p = 0.00; I² = 95.6%) −0.03 [−0.61, 0.55]
RE Model for All Studies (Q = 258.93, df = 16, p = 0.00; I² = 94.6%) 100.00% −0.04 [−0.56, 0.47]
−5
0
3
Hedge's G
Standard Error
0
0.112
0.225
0.337
0.449
−2
−1
0
1
2
3
Mean Difference
White matter FA − brainstem
2.55
1.83
1.12
0.40
−0.31
−1.03
−1.74
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
2
0
−2
0.0
0.2
0.4
0.6
0.8
1.0
1.2
$x_i = 1/\sqrt{v_i + \tau^2}$
Influence on Overall Result
0.0
0.1
0.2
0.3
0.4
0.5
Wu et al. Brai
Wu et al. Brain Res.2
Zheng et al. Sci Rep.1
Zheng et al. Sci Rep.5
Wu et al. Brain Res.1
0
1
2
3
4
5
Squared Pearson Residual
White matter FA − brainstem
Sample Quantiles
−1
0
1
2
−2
−1
0
1
2
Theoretical Quantiles

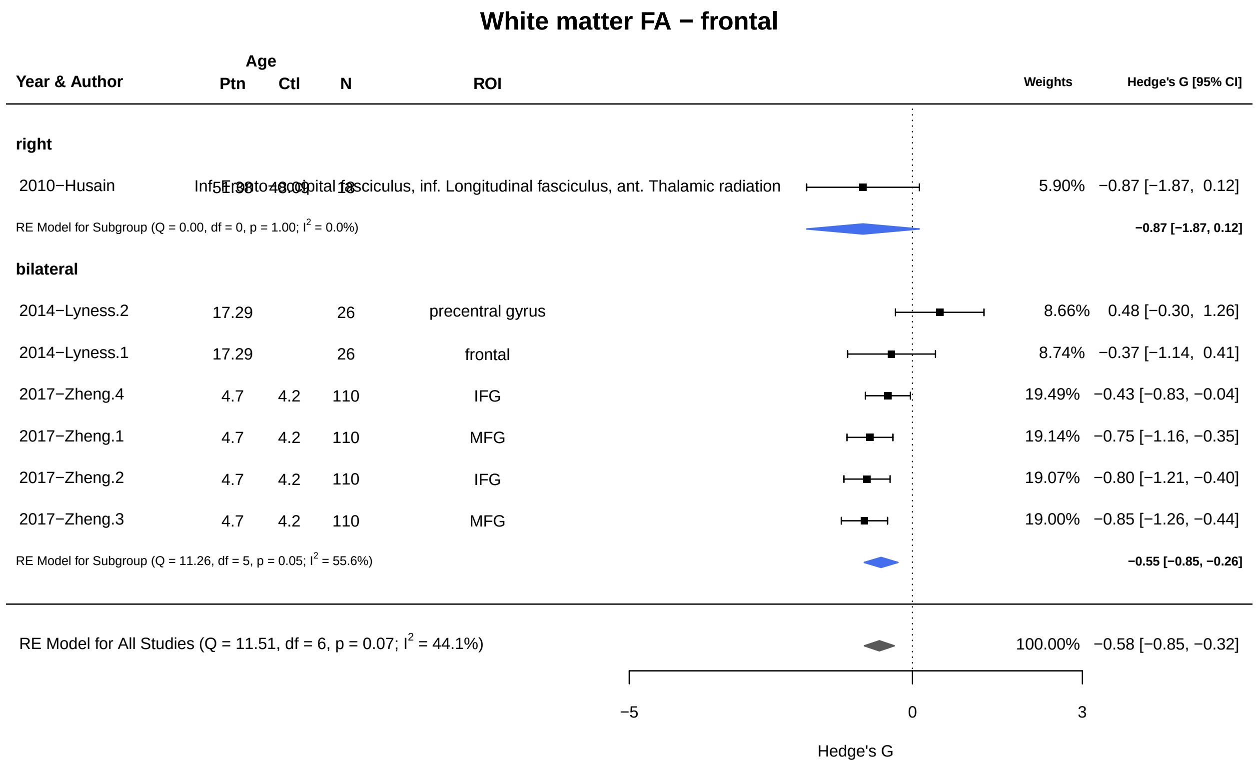

White matter FA − thalmus
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2017−Kim.2 31.6 26.5 37 thalmus 8.32% −0.79 [−1.60, 0.01]
2017−Kim.1 31.6 26.5 37 internal capsule 8.32% −0.79 [−1.60, 0.01]
2013−Miao 14.56 14.75 32 thalmus 8.98% −0.81 [−1.53, −0.09]
2014−Hribar.2 35.4 30.5 28 posterior thalamic radiation 8.57% −0.82 [−1.59, −0.04]
2014−Hribar.1 35.4 30.5 28 retrolenticular part of internal capsule 8.57% −0.82 [−1.59, −0.04]
2009−Kim 29.3 26.5 42 internal capsule 8.94% −1.45 [−2.18, −0.73]
RE Model for Subgroup (Q = 2.48, df = 5, p = 0.78; I2 = 0.0%) −0.93 [−1.24, −0.61]
bilateral
2015−Huang.1 4.7 4.2 44 MGB 9.95% −0.62 [−1.23, −0.01]
2015−Huang.2 4.7 4.2 44 AR 9.92% −0.67 [−1.28, −0.06]
2016−Chinnadurai.3 8.58 8.58 50 LL 10.25% −0.71 [−1.28, −0.13]
2016−Chinnadurai.2 8.58 8.58 50 IC 9.91% −1.30 [−1.92, −0.69]
2016−Chinnadurai.1 8.58 8.58 50 IAC 8.27% −2.95 [−3.76, −2.14]
RE Model for Subgroup (Q = 26.57, df = 4, p = 0.00; I2 = 88.3%) −1.22 [−2.05, −0.39]
RE Model for All Studies (Q = 29.55, df = 10, p = 0.00; I2 = 68.4%) 100.00% −1.05 [−1.42, −0.67]
−5
0
3
Hedge's G

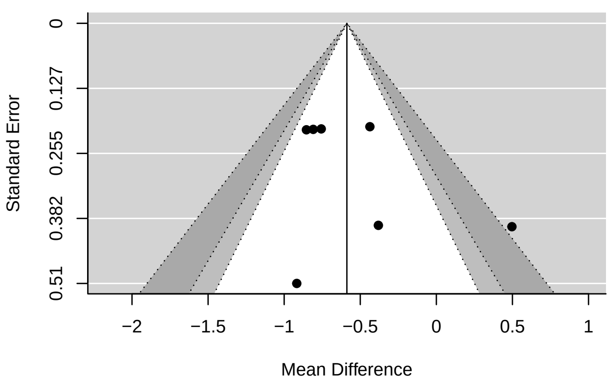

Standard Error
0
0.104
0.208
0.313
0.417
−3
−2
−1
0
Mean Difference

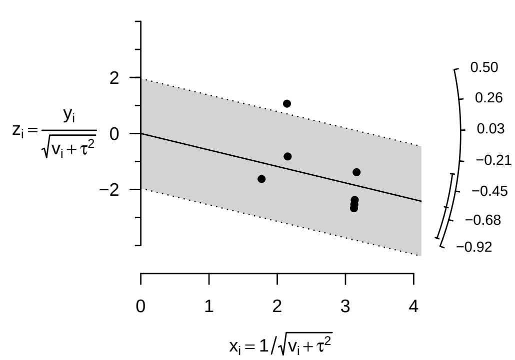

White matter FA − thalmus
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
2
0
−2
−0.63
−1.03
−1.42
−1.82
−2.21
−2.61
−3.00
0.0
0.5
1.0
1.5
2.0
$x_i = 1/\sqrt{v_i + \tau^2}$


Chinnadurai et al. Magn
Influence on Overall Result
0.0
0.5
1.0
1.5
2.0
2.5
0
2
4
6
8
Squared Pearson Residual

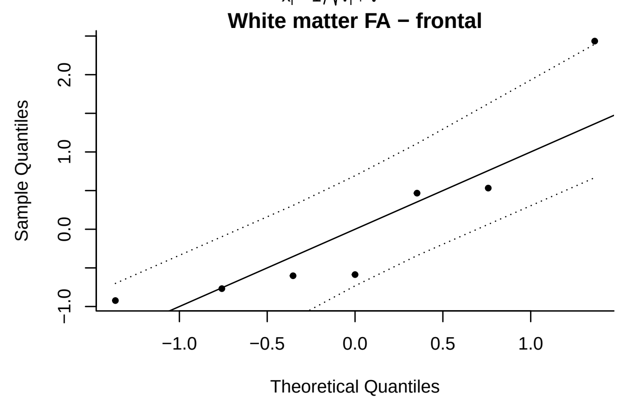

White matter FA − thalmus
Sample Quantiles
0
−1
−2
−3
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Theoretical Quantiles

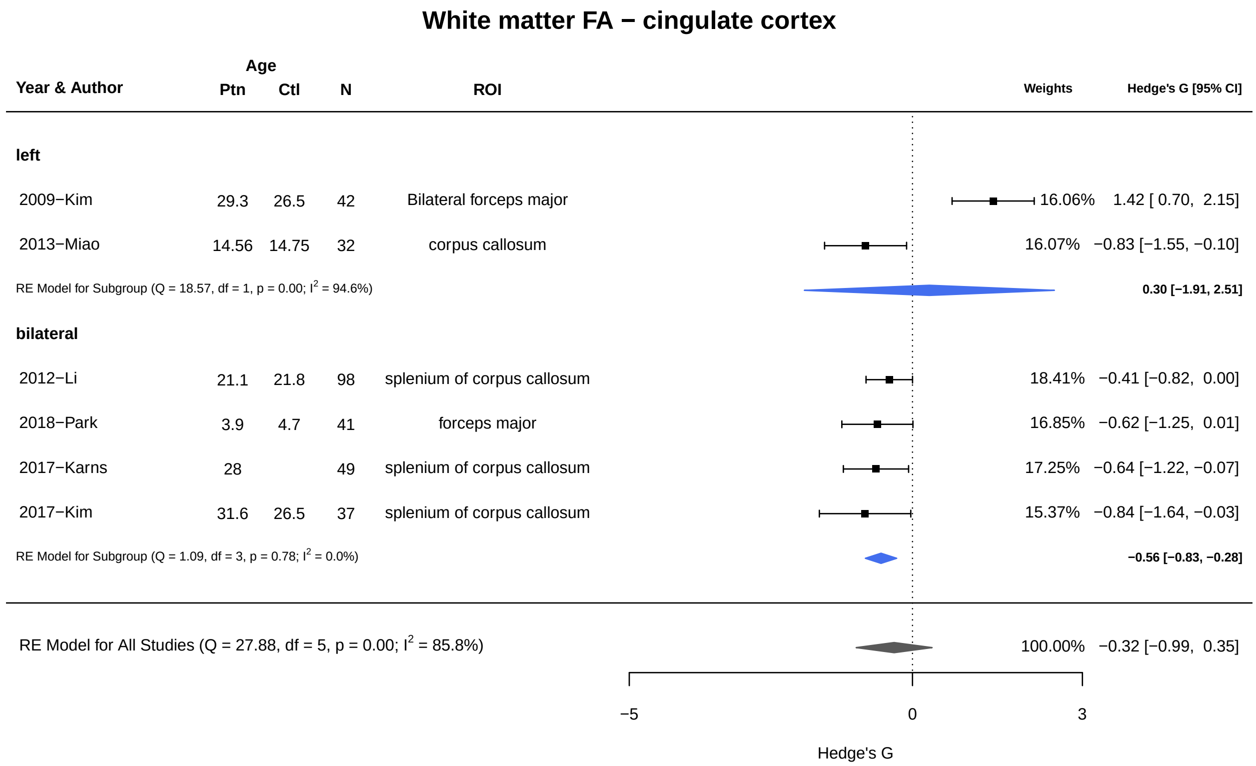

White matter FA − frontal
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2010−Husain
fasciculus, inf. Longitudinal fasciculus, ant. Thalamic radiation
5.90% −0.87 [−1.87, 0.12]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%)
−0.87 [−1.87, 0.12]
bilateral
2014−Lyness.2 17.29 26 precentral gyrus 8.66% 0.48 [−0.30, 1.26]
2014−Lyness.1 17.29 26 frontal 8.74% −0.37 [−1.14, 0.41]
2017−Zheng.4 4.7 4.2 110 IFG 19.49% −0.43 [−0.83, −0.04]
2017−Zheng.1 4.7 4.2 110 MFG 19.14% −0.75 [−1.16, −0.35]
2017−Zheng.2 4.7 4.2 110 IFG 19.07% −0.80 [−1.21, −0.40]
2017−Zheng.3 4.7 4.2 110 MFG 19.00% −0.85 [−1.26, −0.44]
RE Model for Subgroup (Q = 11.26, df = 5, p = 0.05; I² = 55.6%)
−0.55 [−0.85, −0.26]
RE Model for All Studies (Q = 11.51, df = 6, p = 0.07; I² = 44.1%)
100.00% −0.58 [−0.85, −0.32]
−5
0
3
Hedge's G

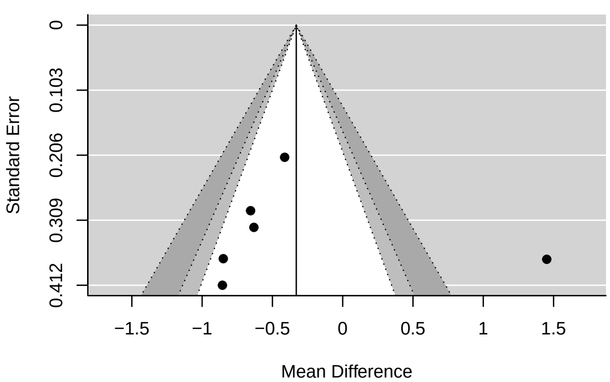

Standard Error
0
0.127
0.255
0.382
0.51
−2
−1.5
−1
−0.5
0
0.5
1
Mean Difference

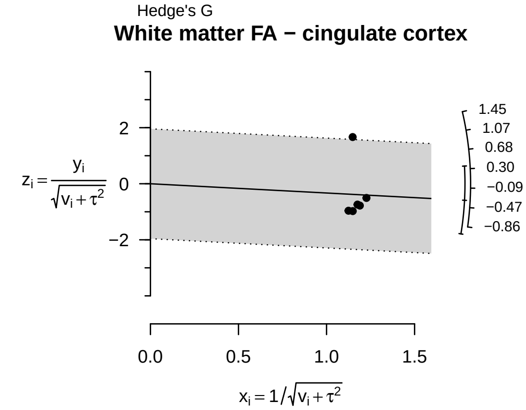

White matter FA − frontal
2
0
−2
0.50
0.26
0.03
−0.21
−0.45
−0.68
−0.92
0
1
2
3
4

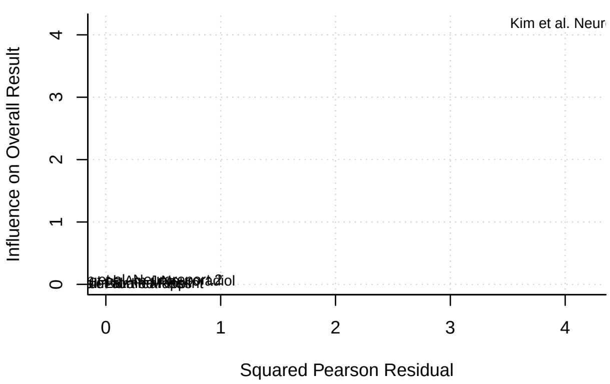

Influence on Overall Result
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Lyness et al. Neu
0
1
2
3
4
5
Squared Pearson Residual

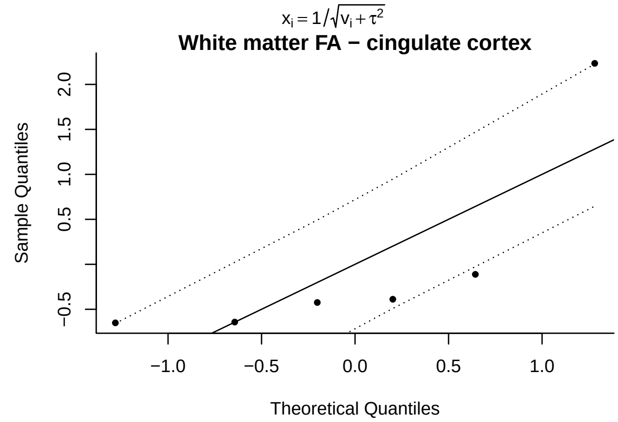

White matter FA − frontal
Sample Quantiles
−1.0
0.0
1.0
2.0
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

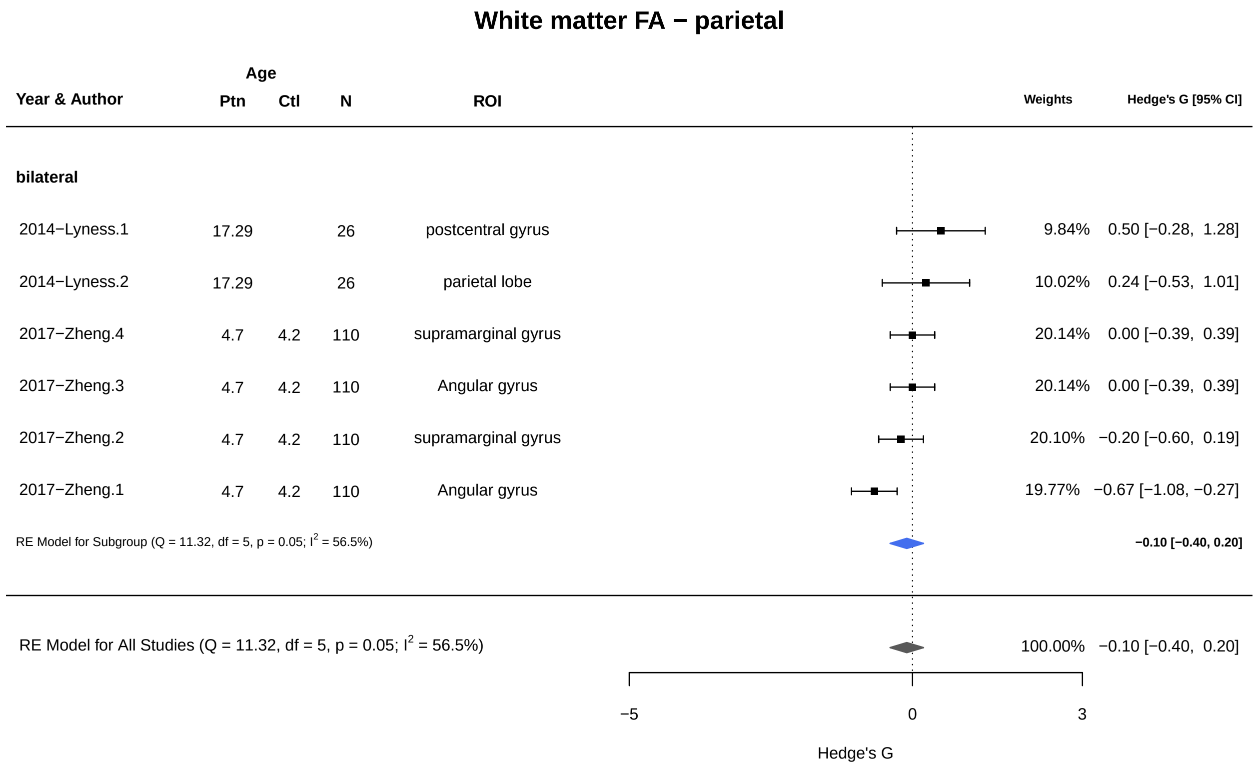

White matter FA − cingulate cortex
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
left
2009−Kim 29.3 26.5 42 Bilateral forceps major 16.06% 1.42 [0.70, 2.15]
2013−Miao 14.56 14.75 32 corpus callosum 16.07% −0.83 [−1.55, −0.10]
RE Model for Subgroup (Q = 18.57, df = 1, p = 0.00; I² = 94.6%) 0.30 [−1.91, 2.51]
bilateral
2012−Li 21.1 21.8 98 splenium of corpus callosum 18.41% −0.41 [−0.82, 0.00]
2018−Park 3.9 4.7 41 forceps major 16.85% −0.62 [−1.25, 0.01]
2017−Karns 28 49 splenium of corpus callosum 17.25% −0.64 [−1.22, −0.07]
2017−Kim 31.6 26.5 37 splenium of corpus callosum 15.37% −0.84 [−1.64, −0.03]
RE Model for Subgroup (Q = 1.09, df = 3, p = 0.78; I² = 0.0%) −0.56 [−0.83, −0.28]
RE Model for All Studies (Q = 27.88, df = 5, p = 0.00; I² = 85.8%) 100.00% −0.32 [−0.99, 0.35]
−5
0
3
Hedge's G

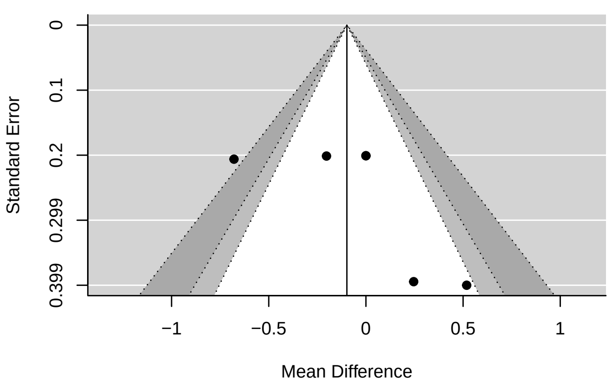

Standard Error
0
0.103
0.206
0.309
0.412
−1.5
−1
−0.5
0
0.5
1
1.5
Mean Difference

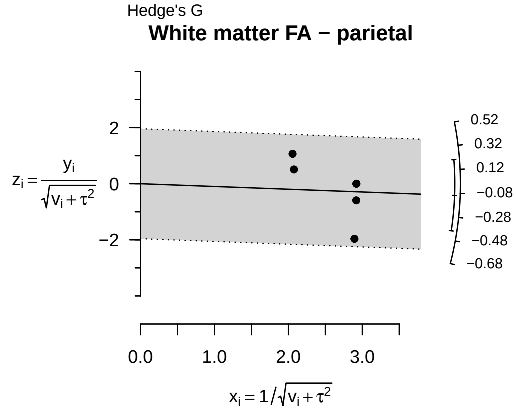

White matter FA − cingulate cortex
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
2
0
−2
1.45
1.07
0.68
0.30
−0.09
−0.47
−0.86
0.0
0.5
1.0
1.5
$x_i = 1/\sqrt{v_i + \tau^2}$

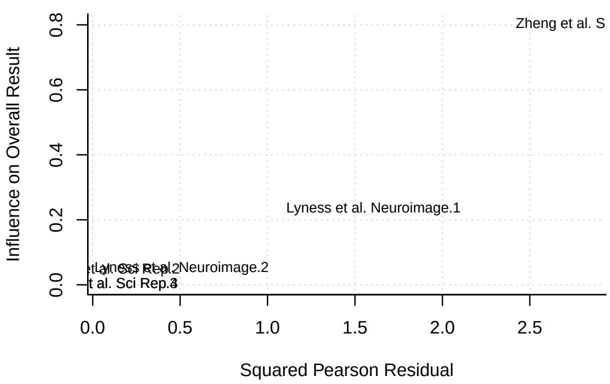

Influence on Overall Result
Kim et al. Neur
0
1
2
3
4
Squared Pearson Residual

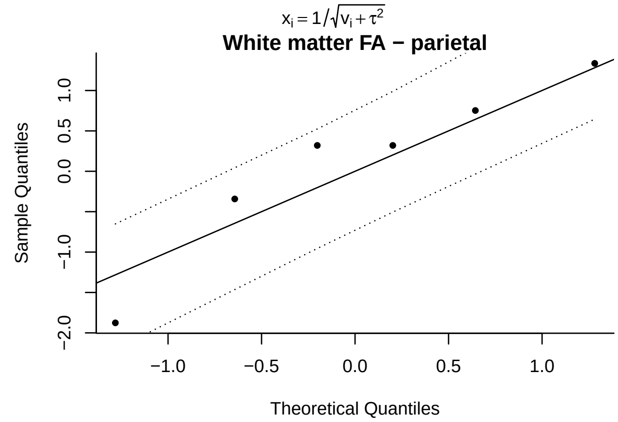

White matter FA − cingulate cortex
Sample Quantiles
−0.5
0.5
1.0
1.5
2.0
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

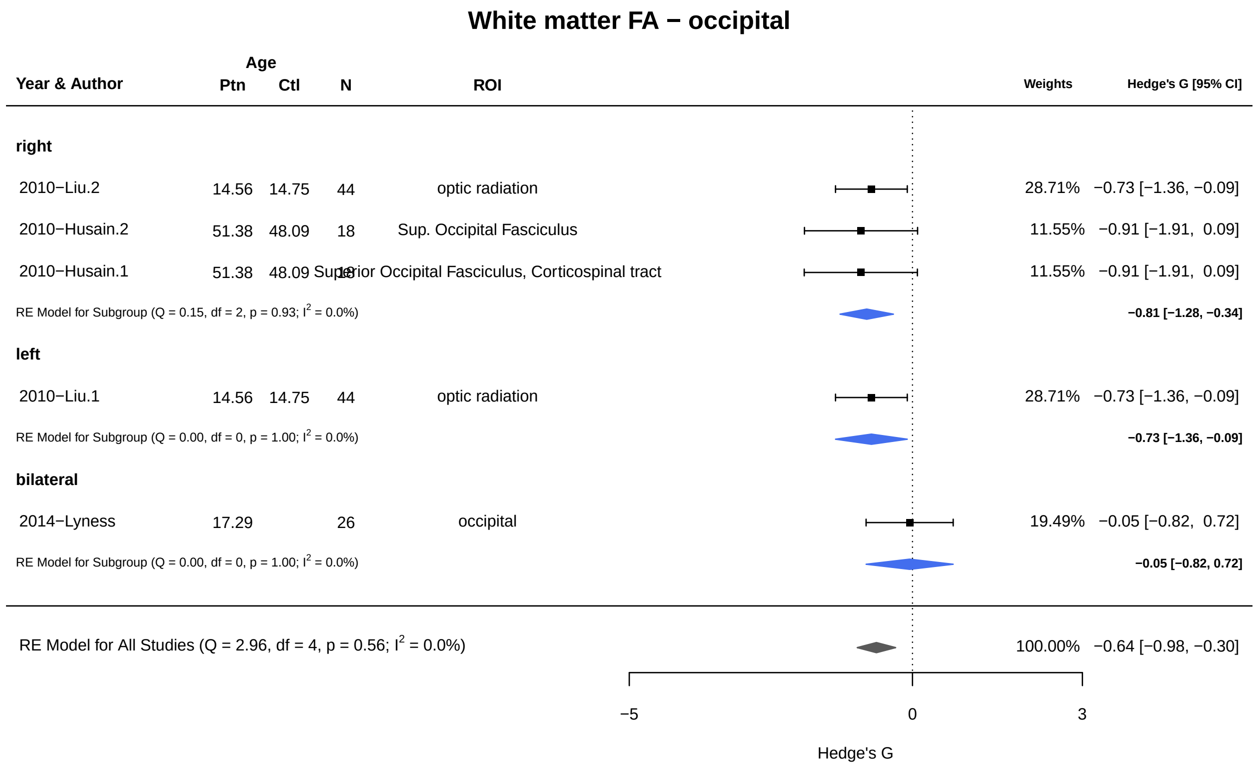

White matter FA − parietal
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
bilateral
2014−Lyness.1 17.29 26 postcentral gyrus 9.84% 0.50 [−0.28, 1.28]
2014−Lyness.2 17.29 26 parietal lobe 10.02% 0.24 [−0.53, 1.01]
2017−Zheng.4 4.7 4.2 110 supramarginal gyrus 20.14% 0.00 [−0.39, 0.39]
2017−Zheng.3 4.7 4.2 110 Angular gyrus 20.14% 0.00 [−0.39, 0.39]
2017−Zheng.2 4.7 4.2 110 supramarginal gyrus 20.10% −0.20 [−0.60, 0.19]
2017−Zheng.1 4.7 4.2 110 Angular gyrus 19.77% −0.67 [−1.08, −0.27]
RE Model for Subgroup (Q = 11.32, df = 5, p = 0.05; I2 = 56.5%) −0.10 [−0.40, 0.20]
RE Model for All Studies (Q = 11.32, df = 5, p = 0.05; I2 = 56.5%) 100.00% −0.10 [−0.40, 0.20]
−5
0
3
Hedge's G

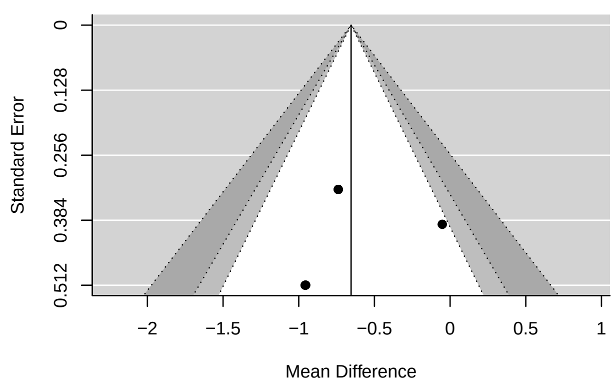

Standard Error
0
0.1
0.2
0.299
0.399
−1
−0.5
0
0.5
1
Mean Difference

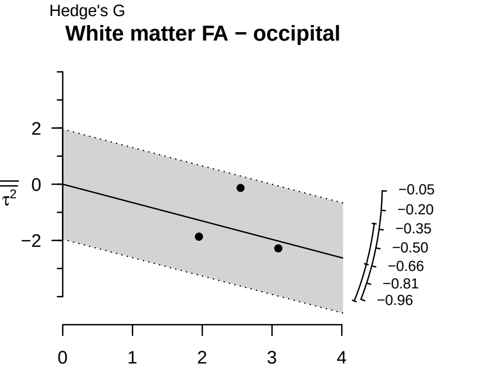

White matter FA − parietal
2
0
−2
0.0
1.0
2.0
3.0
0.52
0.32
0.12
−0.08
−0.28
−0.48
−0.68


Influence on Overall Result
0.0
0.2
0.4
0.6
0.8
Zheng et al. S
Lyness et al. Neuroimage.1
Lyness et al. Neuroimage.2
t al. Sci Rep.3
0.0
0.5
1.0
1.5
2.0
2.5
Squared Pearson Residual


White matter FA − parietal
Sample Quantiles
−2.0
−1.0
0.0
0.5
1.0
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

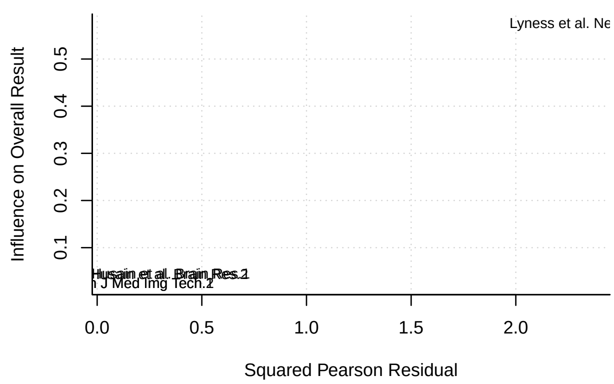






$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$

$x_i = 1/\sqrt{v_i + \tau^2}$



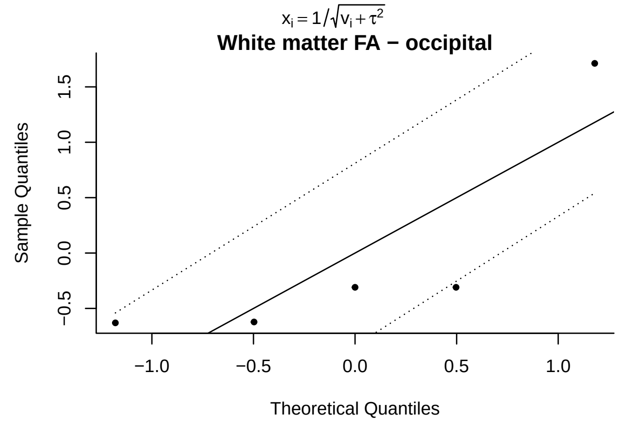
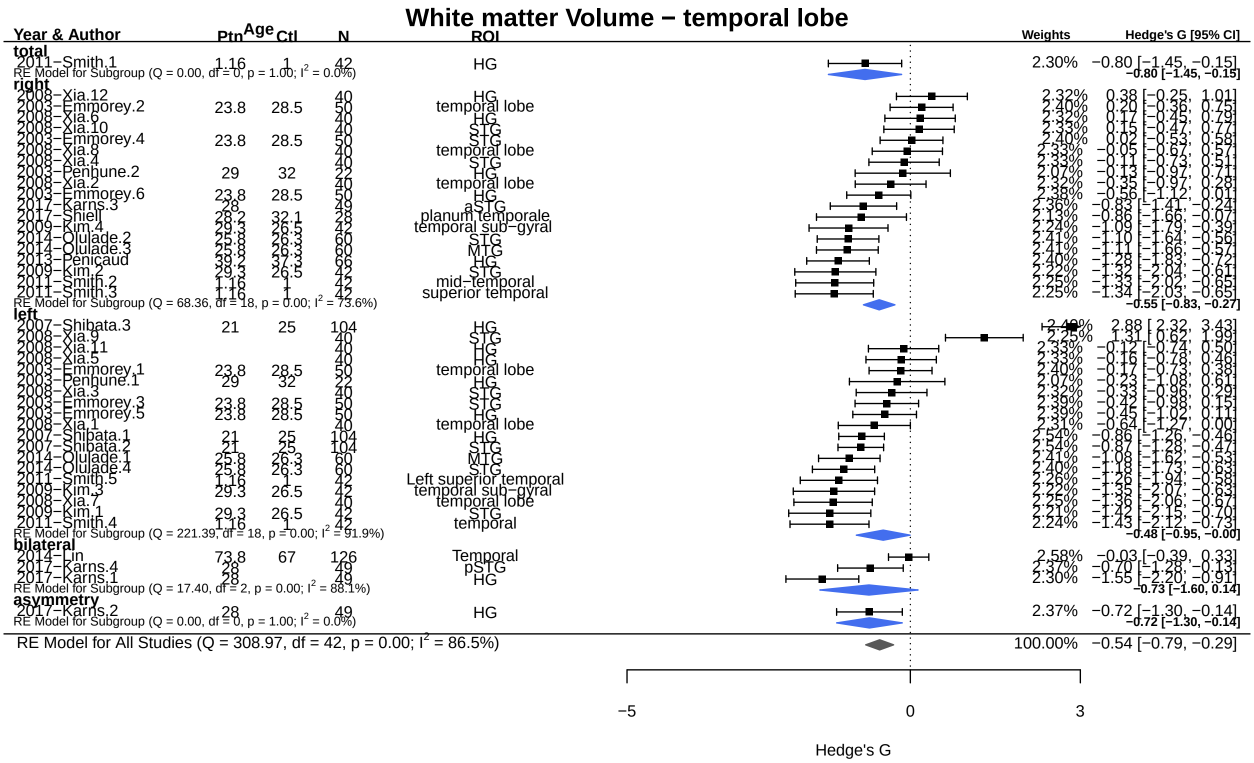
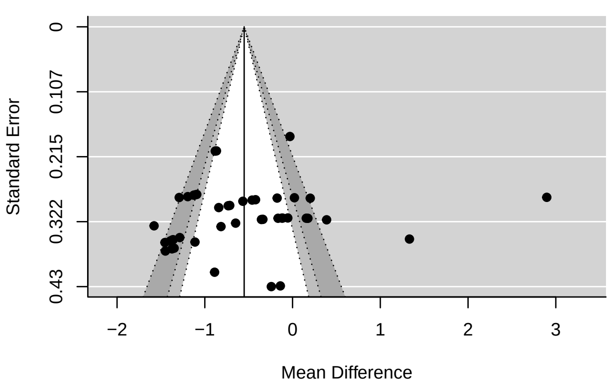
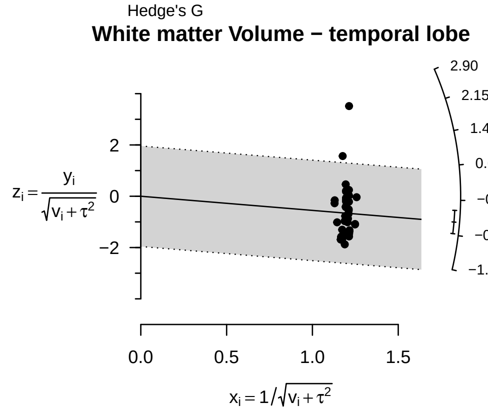
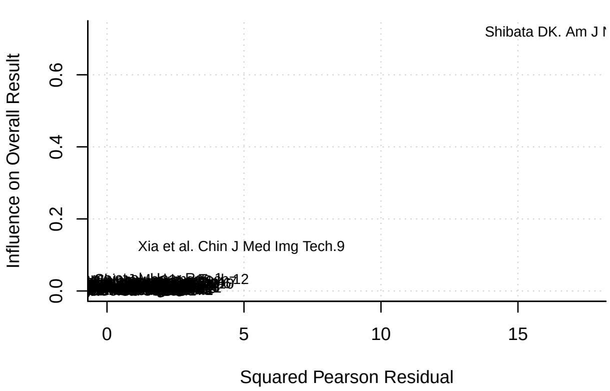


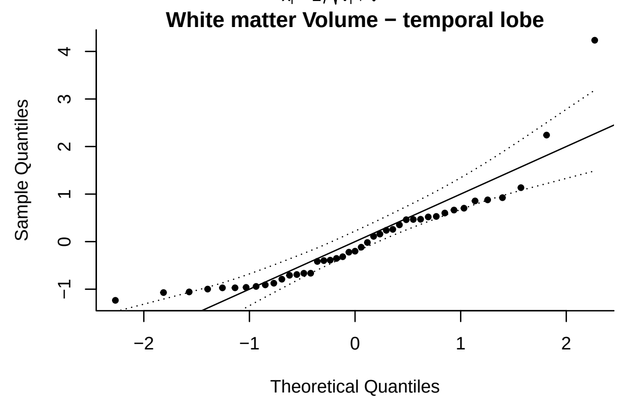
Figure 6 - Meta-regressions of White Matter Volume & Brain Areas: Random effects model no intercept covariated by Side

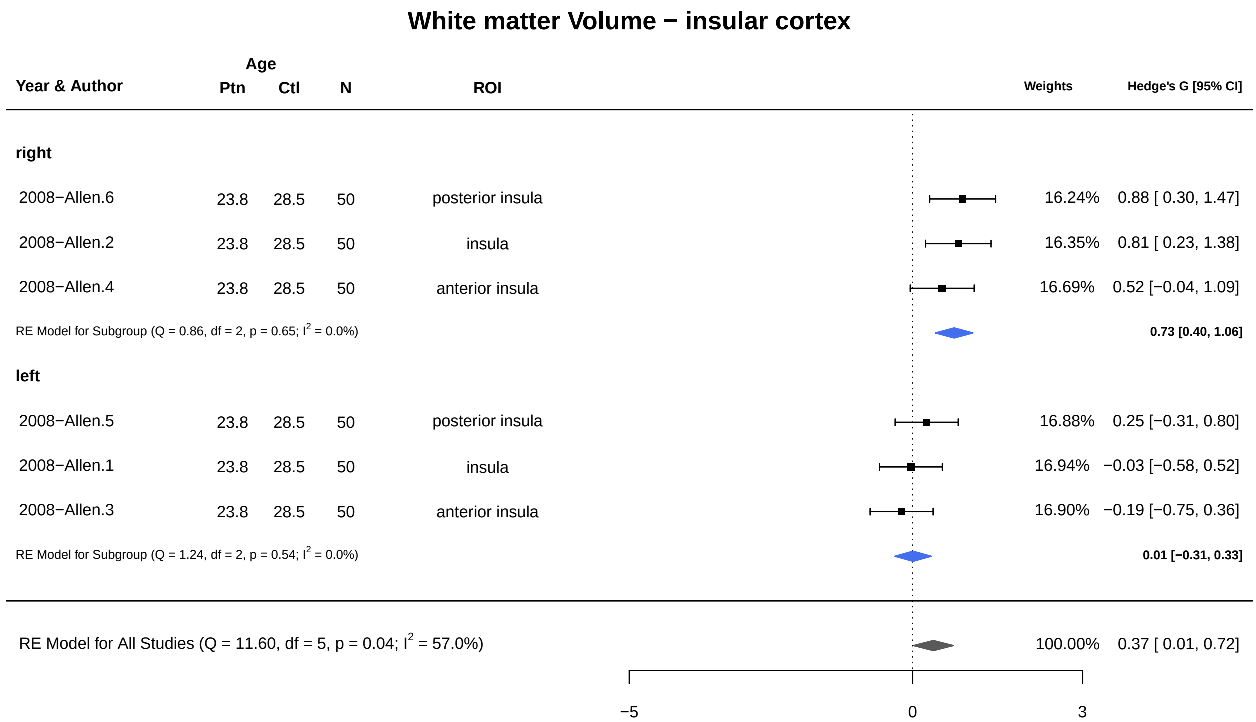


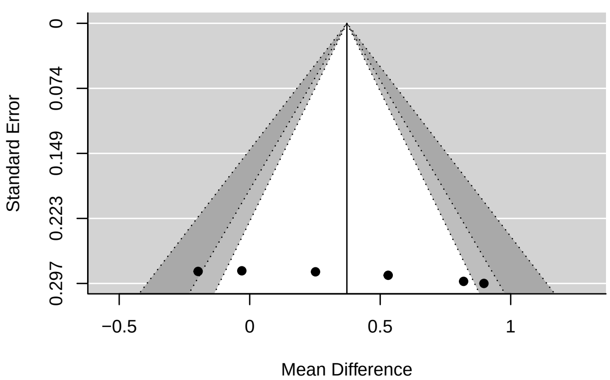


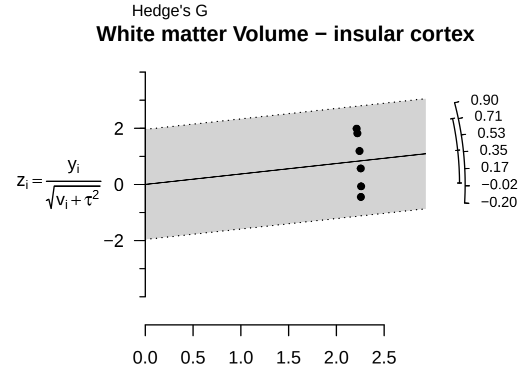






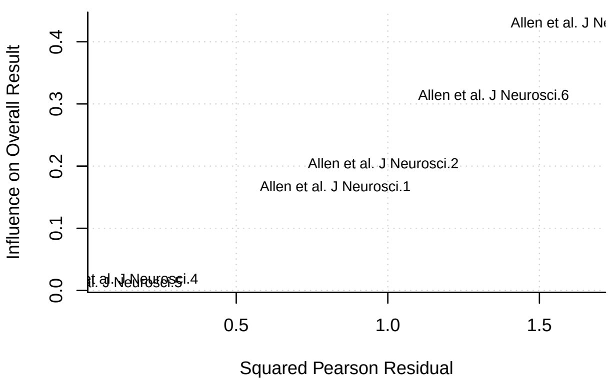


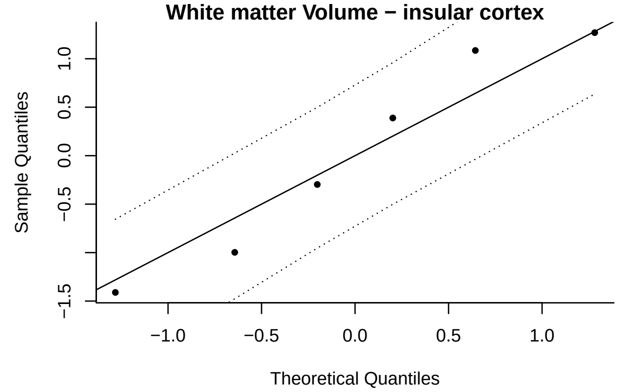


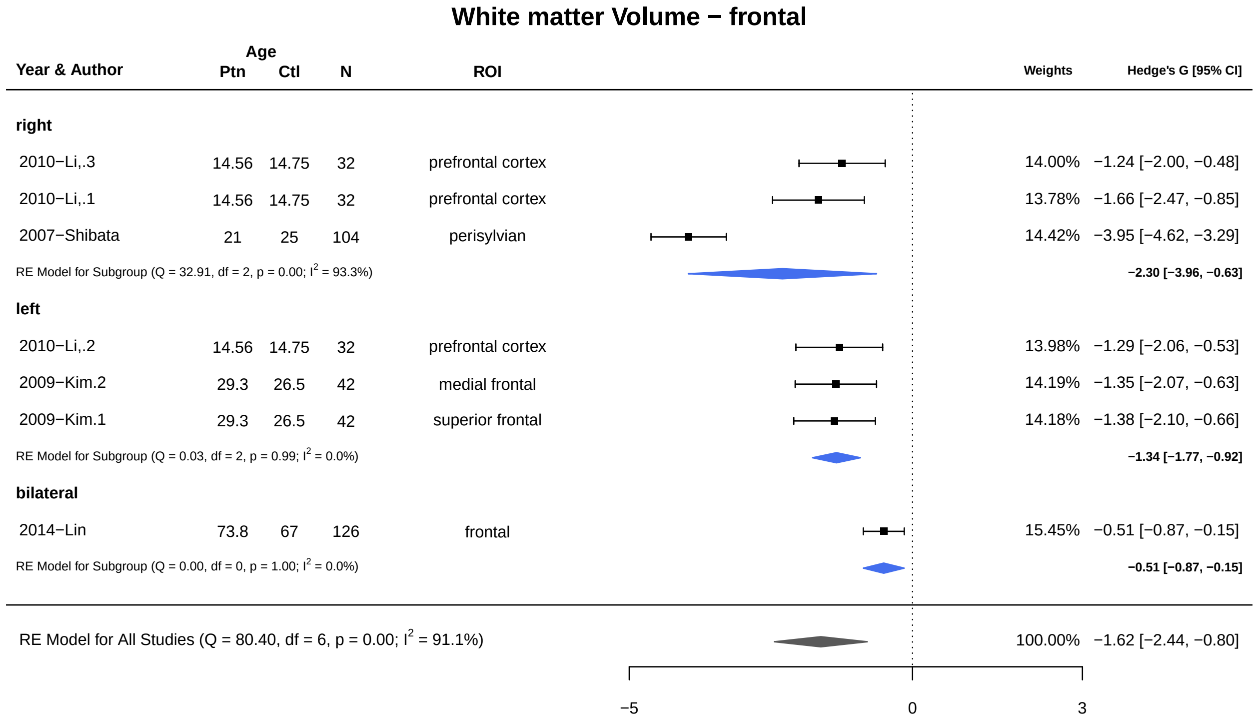


$$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$$

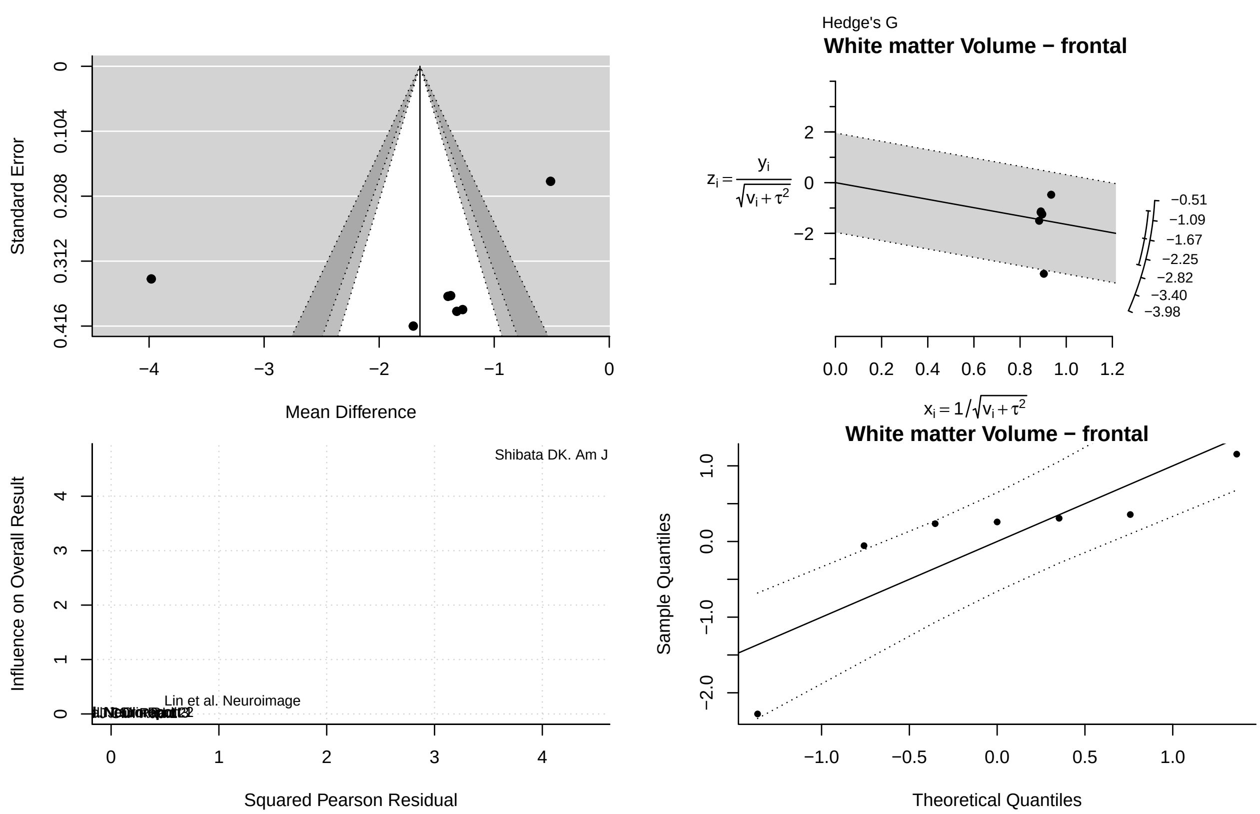
$$x_i = 1/\sqrt{v_i + \tau^2}$$



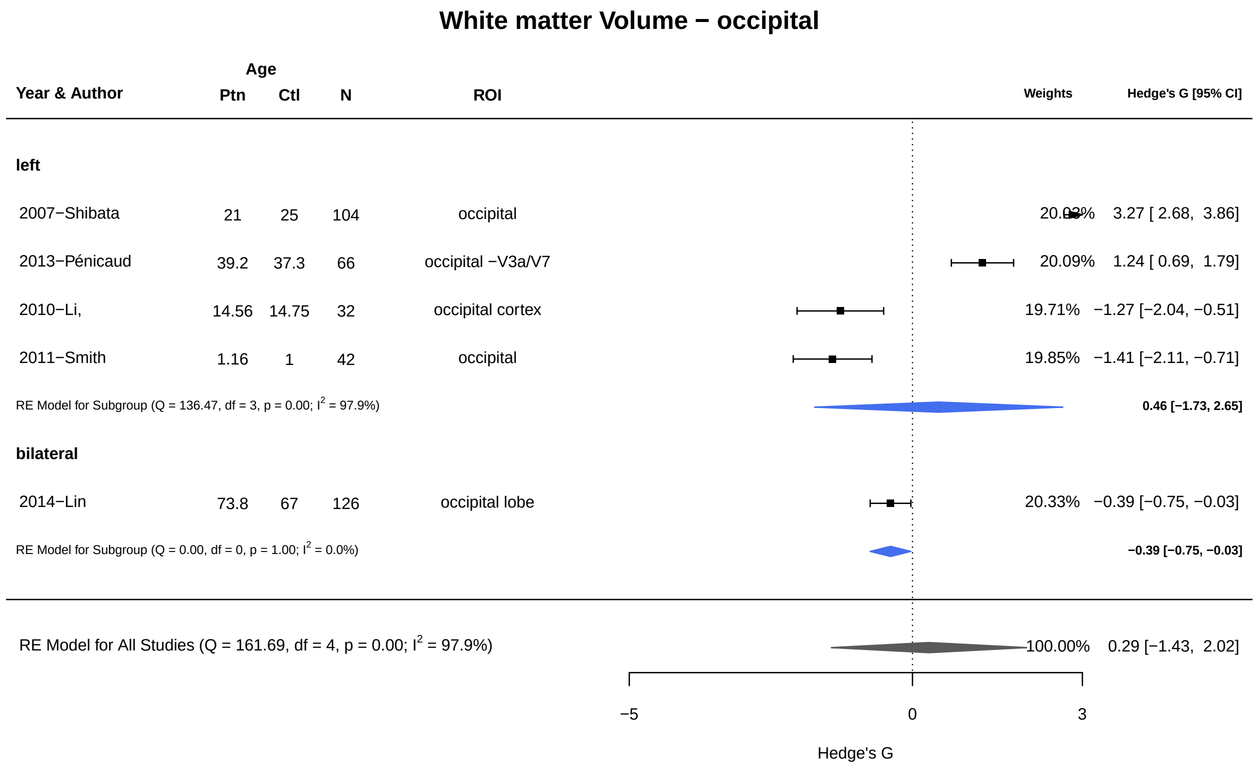


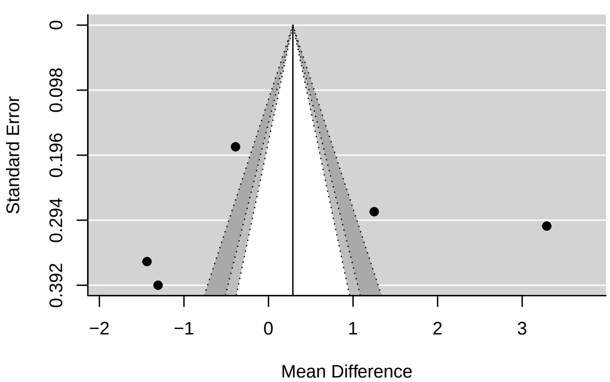


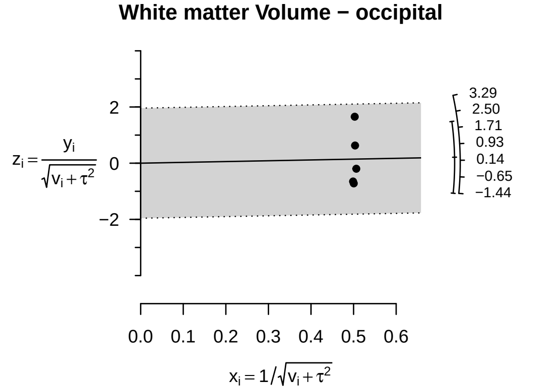
White matter Volume − frontal
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
right
2010−Li,.3 14.56 14.75 32 prefrontal cortex 14.00% −1.24 [−2.00, −0.48]
2010−Li,.1 14.56 14.75 32 prefrontal cortex 13.78% −1.66 [−2.47, −0.85]
2007−Shibata 21 25 104 perisylvian 14.42% −3.95 [−4.62, −3.29]
RE Model for Subgroup (Q = 32.91, df = 2, p = 0.00; I² = 93.3%) −2.30 [−3.96, −0.63]
left
2010−Li,.2 14.56 14.75 32 prefrontal cortex 13.98% −1.29 [−2.06, −0.53]
2009−Kim.2 29.3 26.5 42 medial frontal 14.19% −1.35 [−2.07, −0.63]
2009−Kim.1 29.3 26.5 42 superior frontal 14.18% −1.38 [−2.10, −0.66]
RE Model for Subgroup (Q = 0.03, df = 2, p = 0.99; I² = 0.0%) −1.34 [−1.77, −0.92]
bilateral
2014−Lin 73.8 67 126 frontal 15.45% −0.51 [−0.87, −0.15]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.51 [−0.87, −0.15]
RE Model for All Studies (Q = 80.40, df = 6, p = 0.00; I² = 91.1%) 100.00% −1.62 [−2.44, −0.80]
−5
0
3
Hedge's G

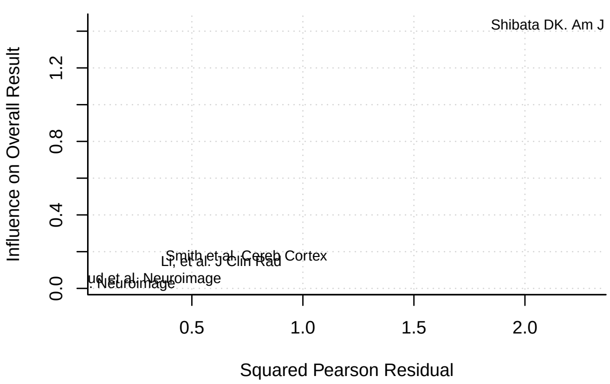


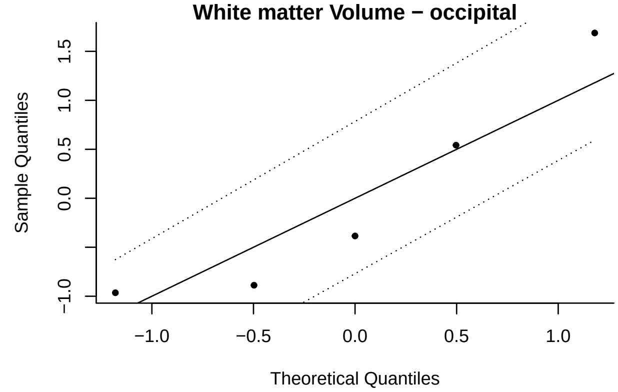
Standard Error
0
0.104
0.208
0.312
0.416
−4
−3
−2
−1
0
Mean Difference
White matter Volume − frontal
2
0
−2
−0.51
−1.09
−1.67
−2.25
−2.82
−3.40
−3.98
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Influence on Overall Result
Shibata DK. Am J
Lin et al. Neuroimage
0
1
2
3
4
Squared Pearson Residual
White matter Volume − frontal
Sample Quantiles
1.0
0.0
−1.0
−2.0
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

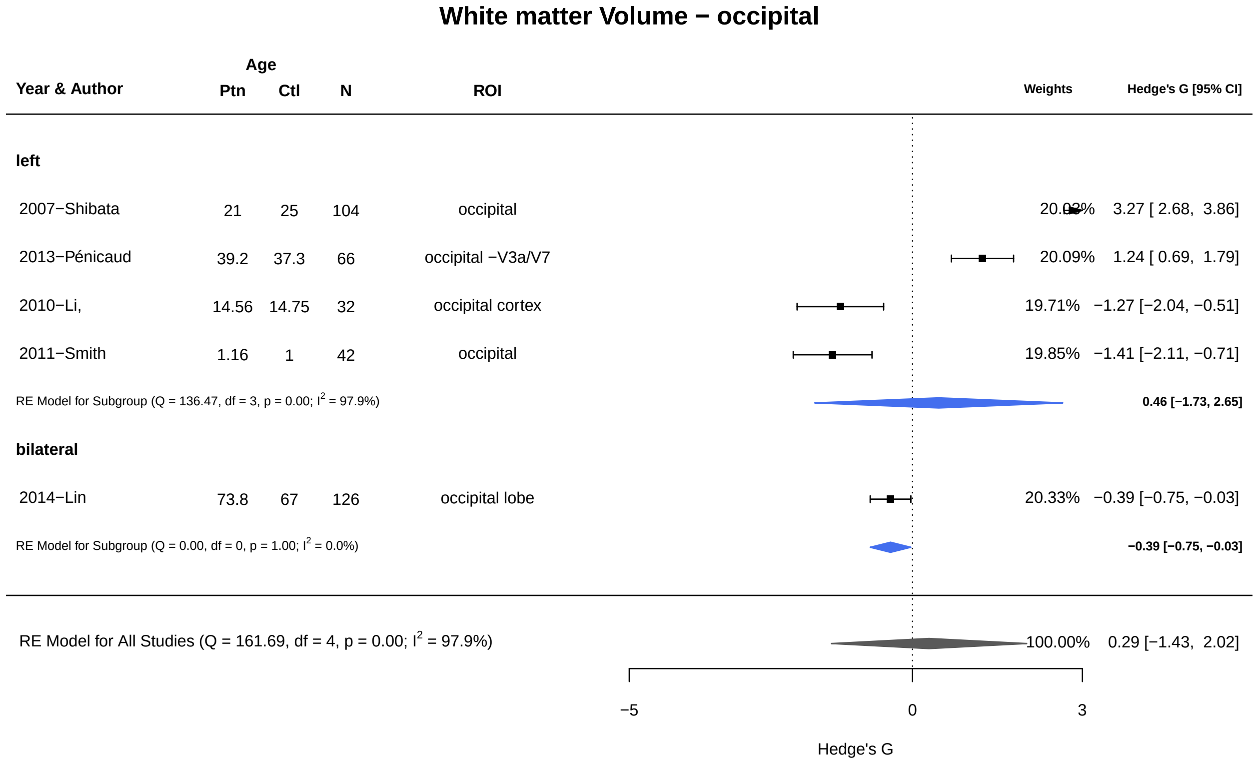

White matter Volume − occipital
Age
Year & Author
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
left
2007−Shibata 21 25 104 occipital 20.02% 3.27 [2.68, 3.86]
2013−Pénicaud 39.2 37.3 66 occipital −V3a/V7 20.09% 1.24 [0.69, 1.79]
2010−Li, 14.56 14.75 32 occipital cortex 19.71% −1.27 [−2.04, −0.51]
2011−Smith 1.16 1 42 occipital 19.85% −1.41 [−2.11, −0.71]
RE Model for Subgroup (Q = 136.47, df = 3, p = 0.00; I2 = 97.9%) 0.46 [−1.73, 2.65]
bilateral
2014−Lin 73.8 67 126 occipital lobe 20.33% −0.39 [−0.75, −0.03]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I2 = 0.0%) −0.39 [−0.75, −0.03]
RE Model for All Studies (Q = 161.69, df = 4, p = 0.00; I2 = 97.9%) 100.00% 0.29 [−1.43, 2.02]
−5
0
3
Hedge's G

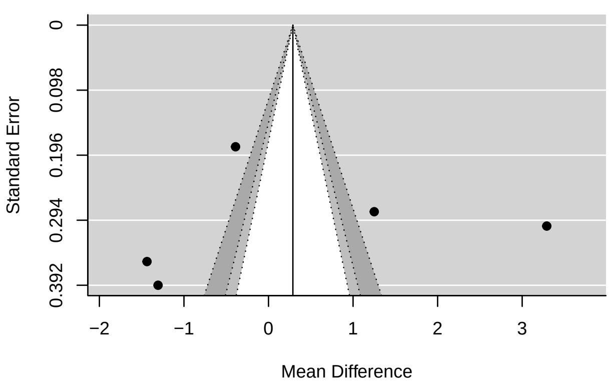

Standard Error
0
0.098
0.196
0.294
0.392
−2
−1
0
1
2
3
Mean Difference

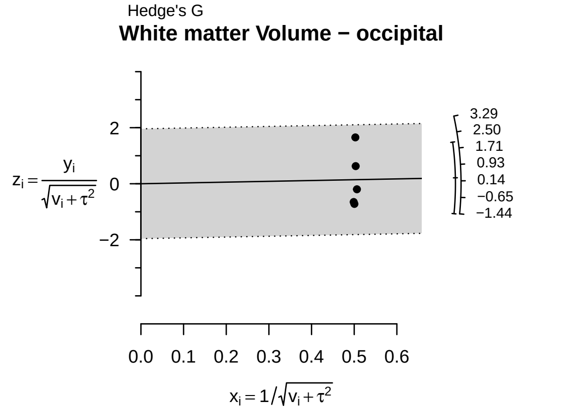

White matter Volume − occipital
$z_i = \frac{y_i}{\sqrt{v_i + \tau^2}}$
2
0
−2
3.29
2.50
1.71
0.93
0.14
−0.65
−1.44
0.0
0.1
0.2
0.3
0.4
0.5
0.6
$x_i = 1/\sqrt{v_i + \tau^2}$

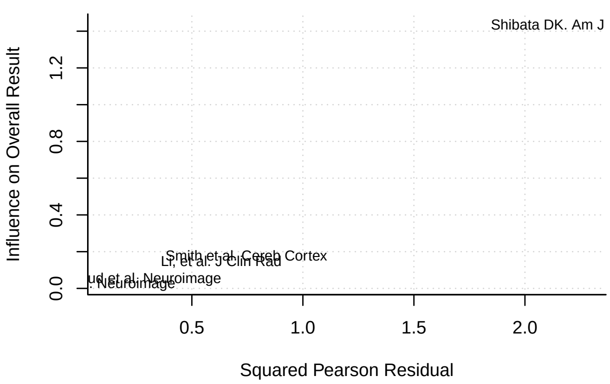

Influence on Overall Result
0.0
0.4
0.8
1.2
Shibata DK. Am J
Smith et al. Cereb Cortex
Li, et al. J Clin Rad
ud et al. Neuroimage
: Neuroimage
0.5
1.0
1.5
2.0
Squared Pearson Residual

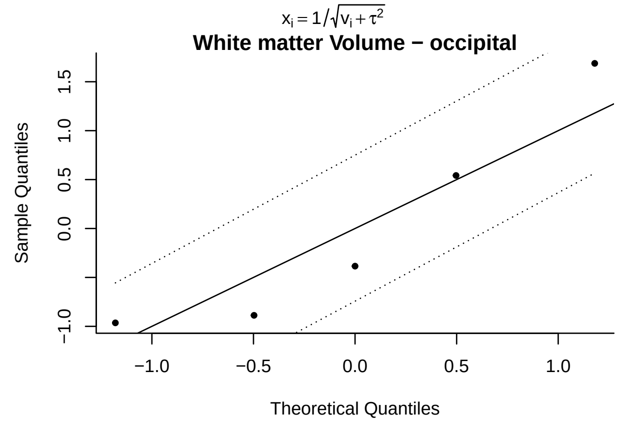

White matter Volume − occipital
Sample Quantiles
−1.0
0.0
0.5
1.0
1.5
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

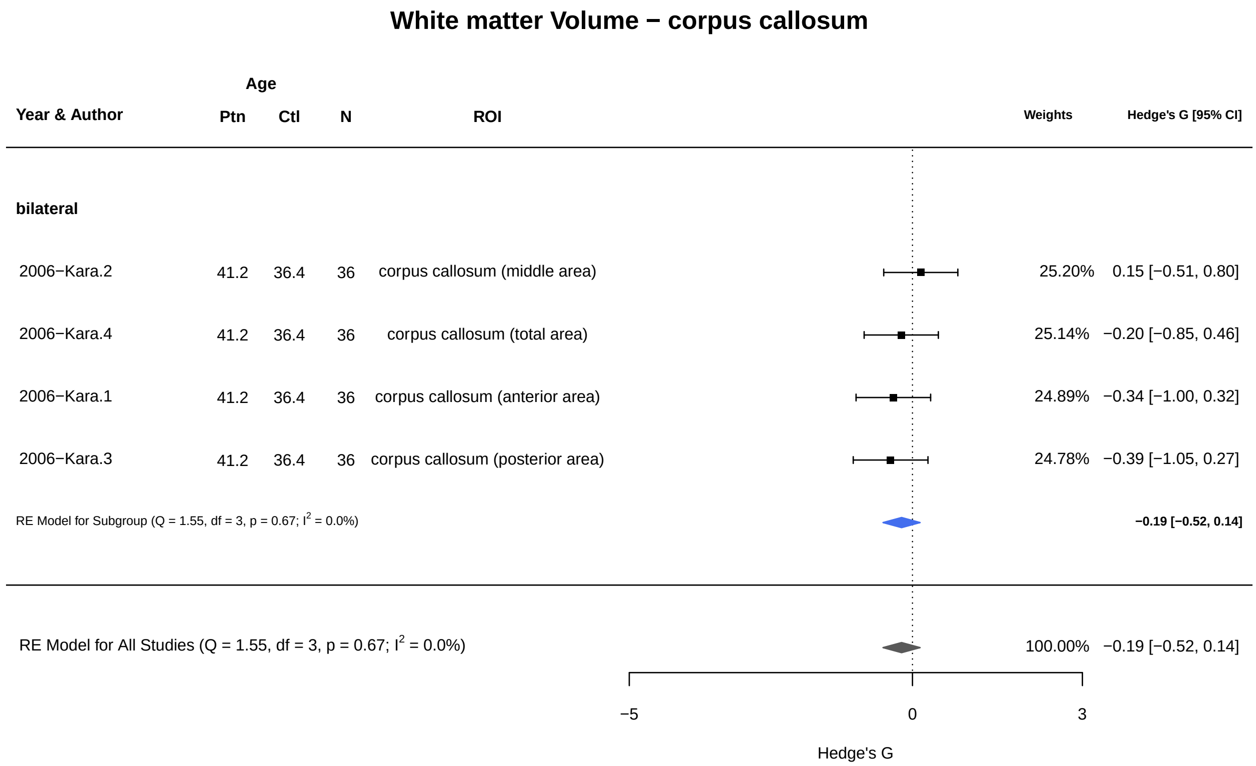

White matter Volume − occipital
Year & Author
Age
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
left
2007−Shibata 21 25 104 occipital 20.02% 3.27 [2.68, 3.86]
2013−Pénicaud 39.2 37.3 66 occipital −V3a/V7 20.09% 1.24 [0.69, 1.79]
2010−Li, 14.56 14.75 32 occipital cortex 19.71% −1.27 [−2.04, −0.51]
2011−Smith 1.16 1 42 occipital 19.85% −1.41 [−2.11, −0.71]
RE Model for Subgroup (Q = 136.47, df = 3, p = 0.00; I² = 97.9%) 0.46 [−1.73, 2.65]
bilateral
2014−Lin 73.8 67 126 occipital lobe 20.33% −0.39 [−0.75, −0.03]
RE Model for Subgroup (Q = 0.00, df = 0, p = 1.00; I² = 0.0%) −0.39 [−0.75, −0.03]
RE Model for All Studies (Q = 161.69, df = 4, p = 0.00; I² = 97.9%) 100.00% 0.29 [−1.43, 2.02]
−5
0
3
Hedge's G

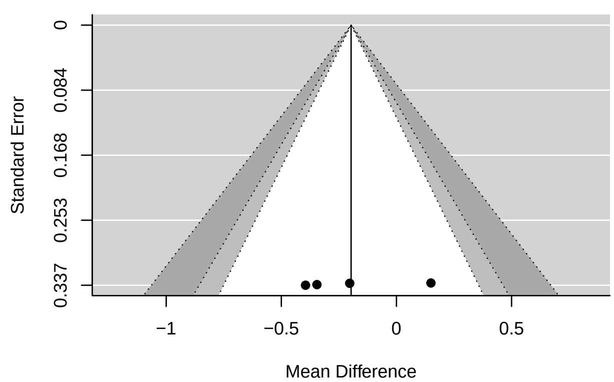

Standard Error
0
0.098
0.196
0.294
0.392
−2
−1
0
1
2
3
Mean Difference

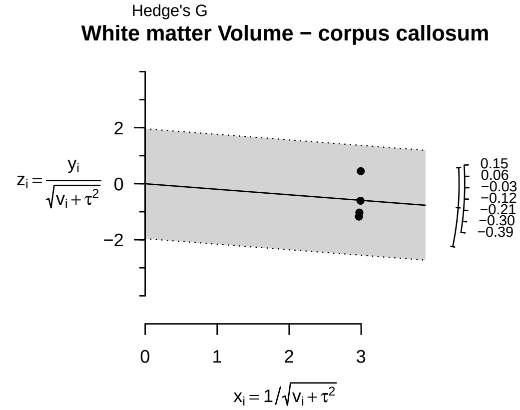

White matter Volume − occipital
2
0
−2
3.29
2.50
1.71
0.93
0.14
−0.65
−1.44
0.0
0.1
0.2
0.3
0.4
0.5
0.6

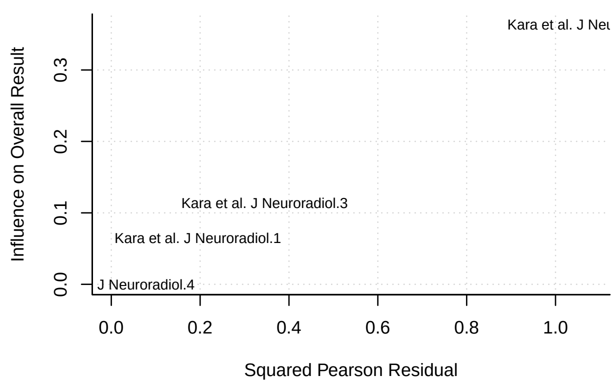

Influence on Overall Result
0.0
0.4
0.8
1.2
Shibata DK. Am J
Smith et al. Cereb Cortex
Li, et al. J Clin Rad
ud et al. Neuroimage
: Neuroimage
0.5
1.0
1.5
2.0
Squared Pearson Residual

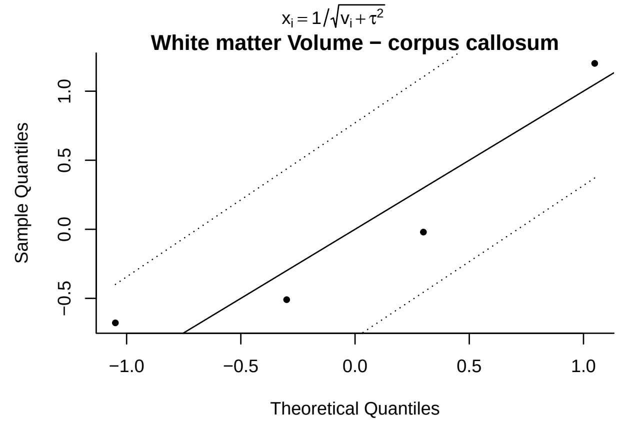

White matter Volume − occipital
Sample Quantiles
−1.0
0.0
0.5
1.0
1.5
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles


White matter Volume − corpus callosum
Age
Year & Author
Ptn
Ctl
N
ROI
Weights
Hedge's G [95% CI]
bilateral
2006−Kara.2 41.2 36.4 36 corpus callosum (middle area) 25.20% 0.15 [−0.51, 0.80]
2006−Kara.4 41.2 36.4 36 corpus callosum (total area) 25.14% −0.20 [−0.85, 0.46]
2006−Kara.1 41.2 36.4 36 corpus callosum (anterior area) 24.89% −0.34 [−1.00, 0.32]
2006−Kara.3 41.2 36.4 36 corpus callosum (posterior area) 24.78% −0.39 [−1.05, 0.27]
RE Model for Subgroup (Q = 1.55, df = 3, p = 0.67; I2 = 0.0%) −0.19 [−0.52, 0.14]
RE Model for All Studies (Q = 1.55, df = 3, p = 0.67; I2 = 0.0%) 100.00% −0.19 [−0.52, 0.14]
−5
0
3
Hedge's G


Standard Error
0
0.084
0.168
0.253
0.337
−1
−0.5
0
0.5
Mean Difference

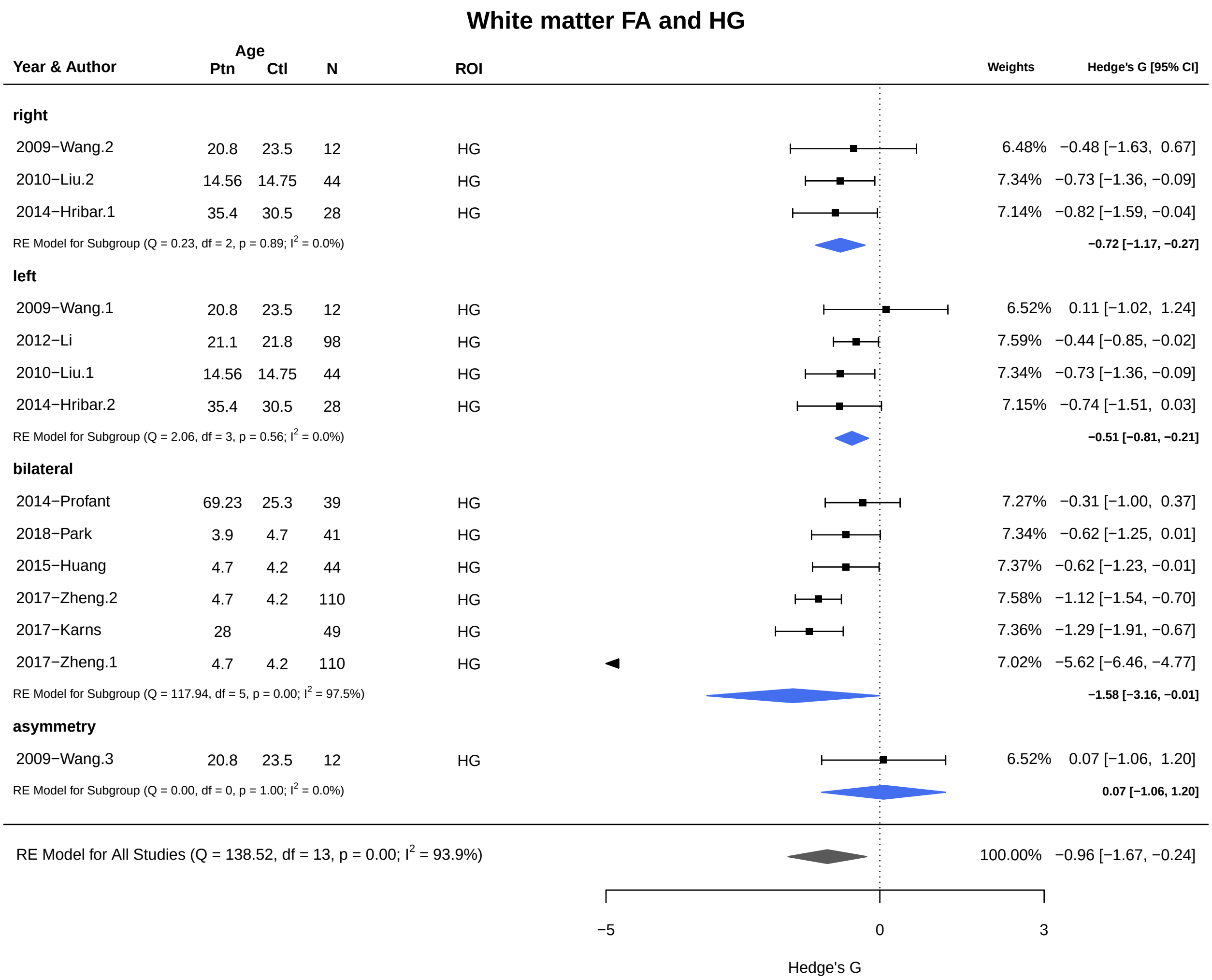

White matter Volume − corpus callosum
2
0
−2
0.15
0.06
−0.03
−0.12
−0.21
−0.30
−0.39
0
1
2
3


Influence on Overall Result
0.0
0.1
0.2
0.3
Kara et al. J Neu
Kara et al. J Neuroradiol.3
Kara et al. J Neuroradiol.1
J Neuroradiol.4
0.0
0.2
0.4
0.6
0.8
1.0
Squared Pearson Residual

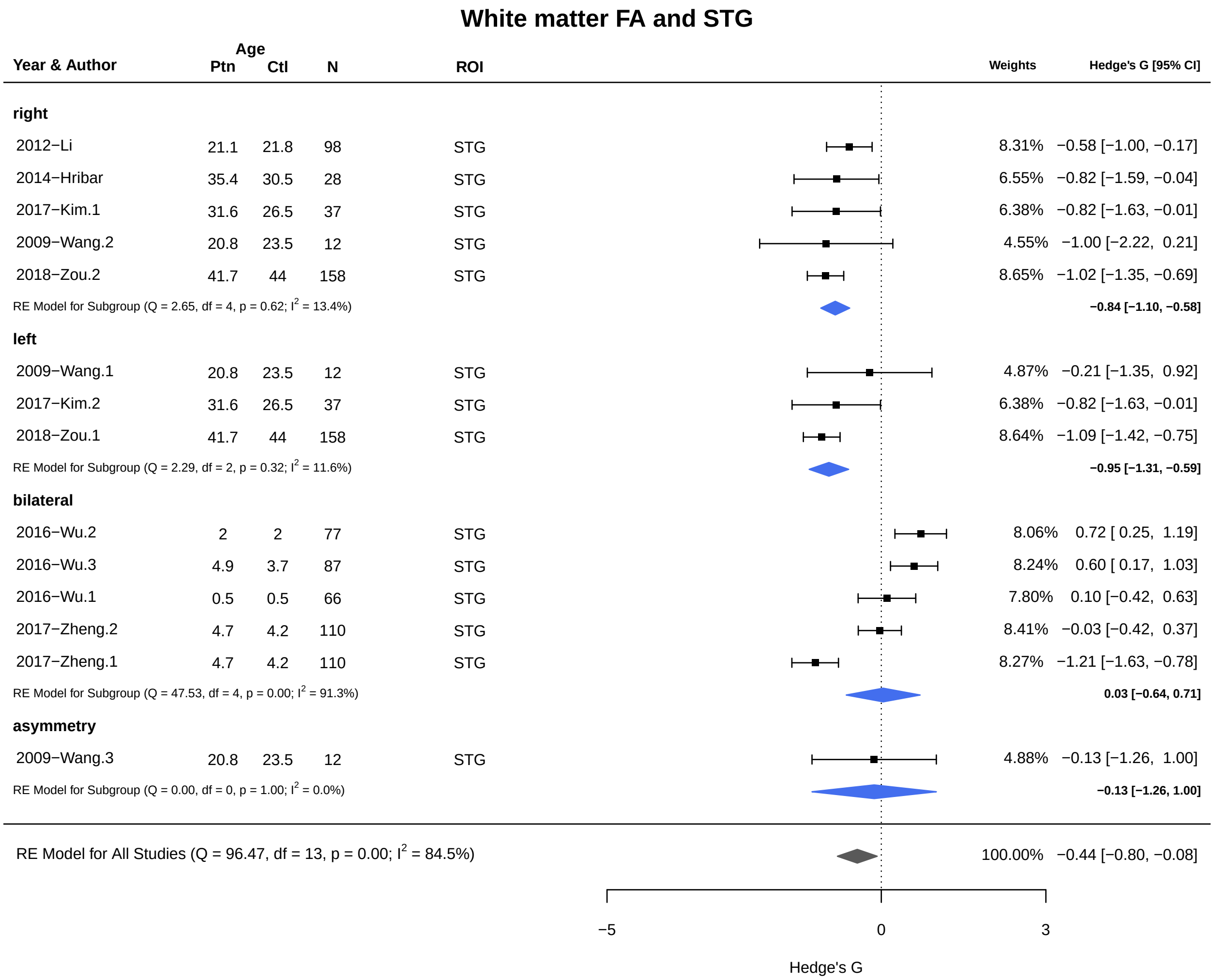

White matter Volume − corpus callosum
Sample Quantiles
−0.5
0.0
0.5
1.0
−1.0
−0.5
0.0
0.5
1.0
Theoretical Quantiles

Supplementary material: Forest-plots of other Measures

Hesch gyrus FA white matter

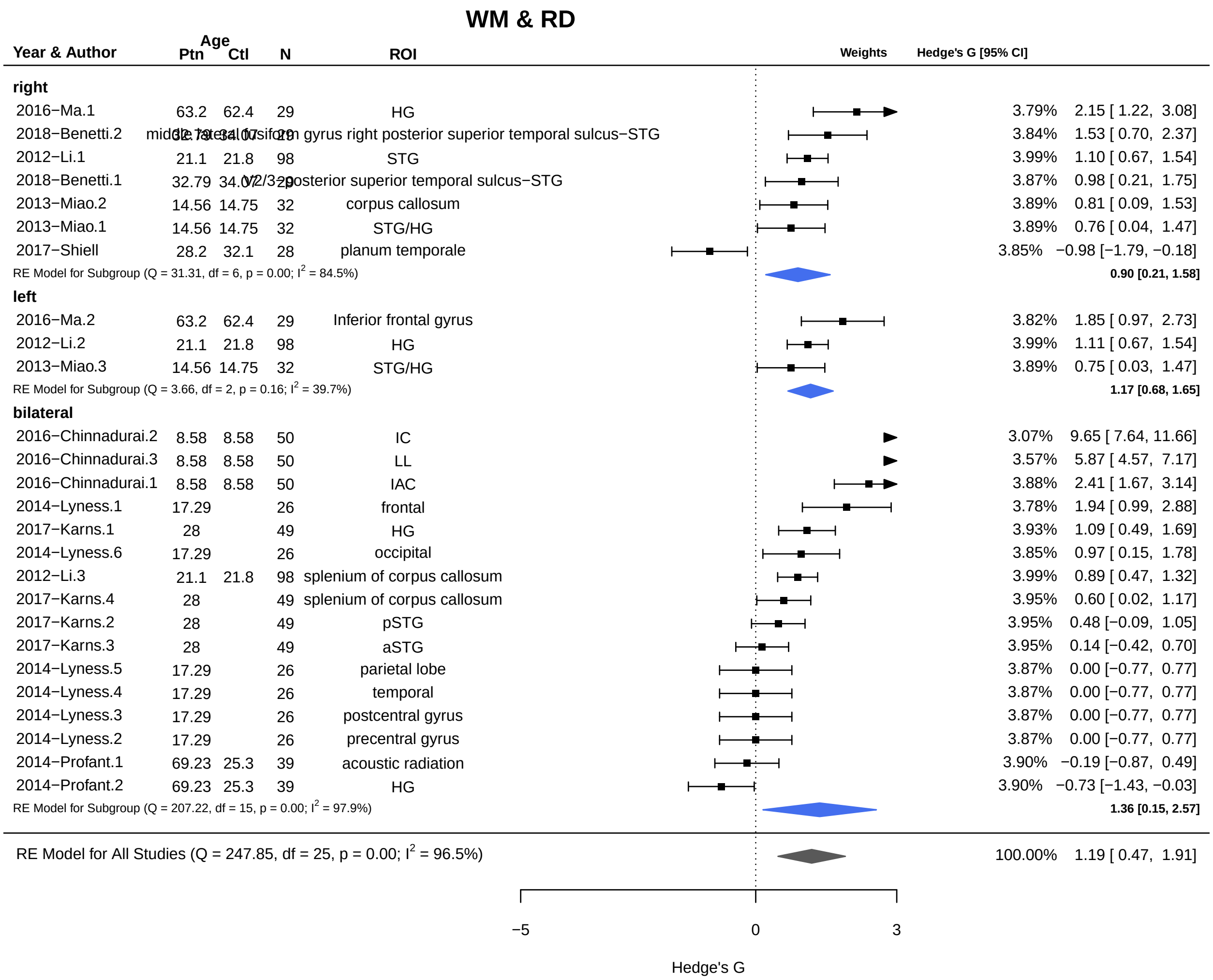


STG Volume White matter

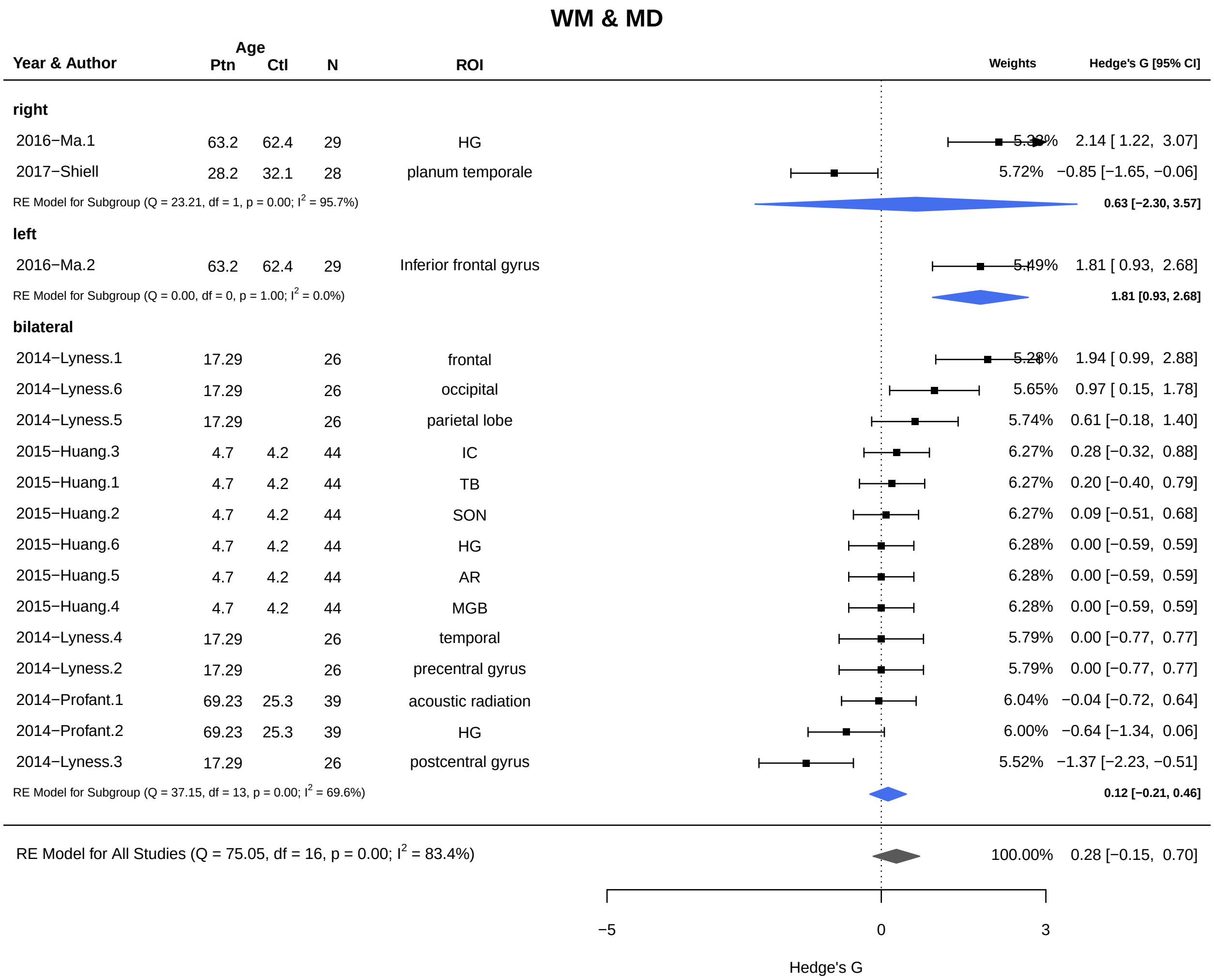


Measures of White matter Integrity

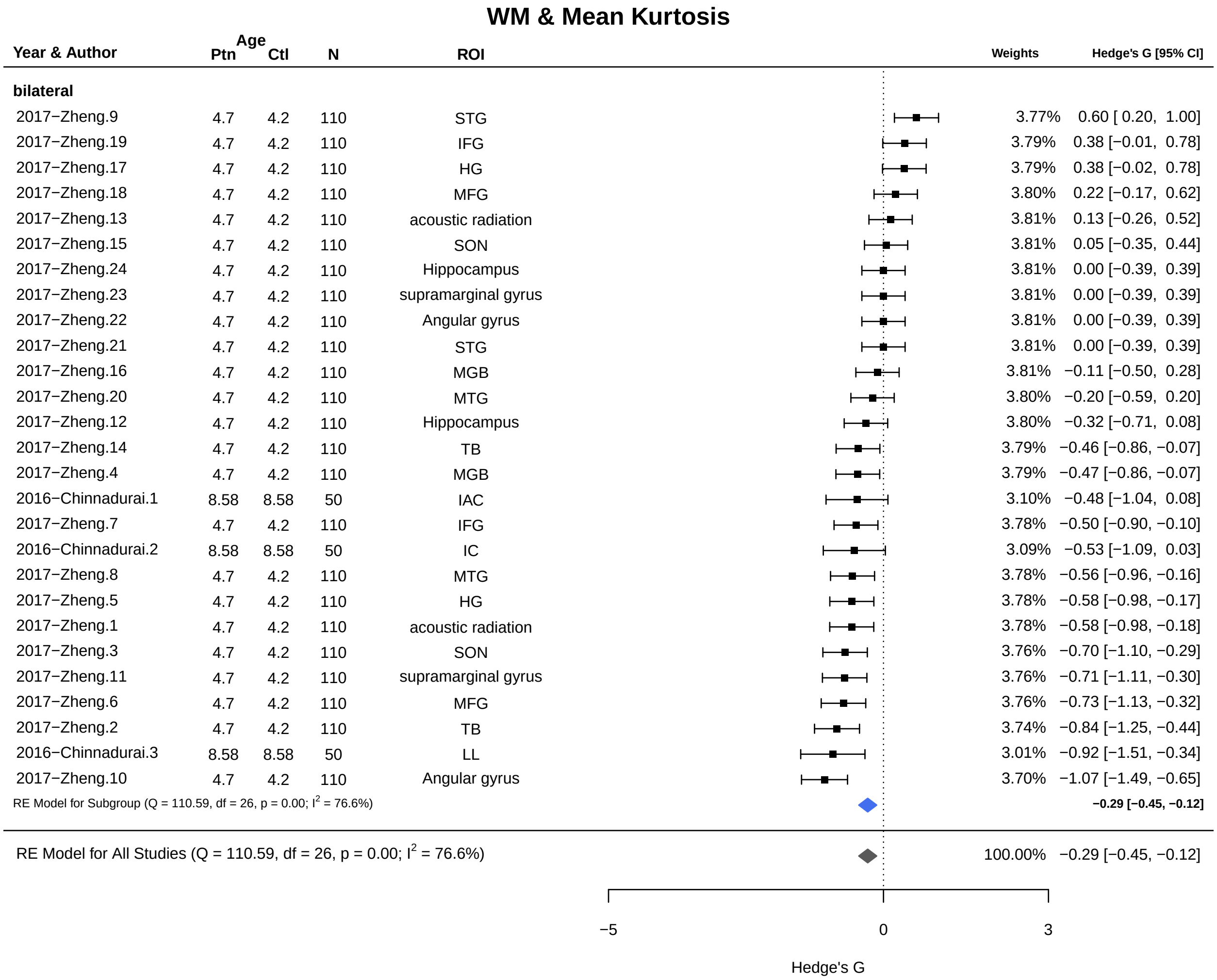
White matter: RD



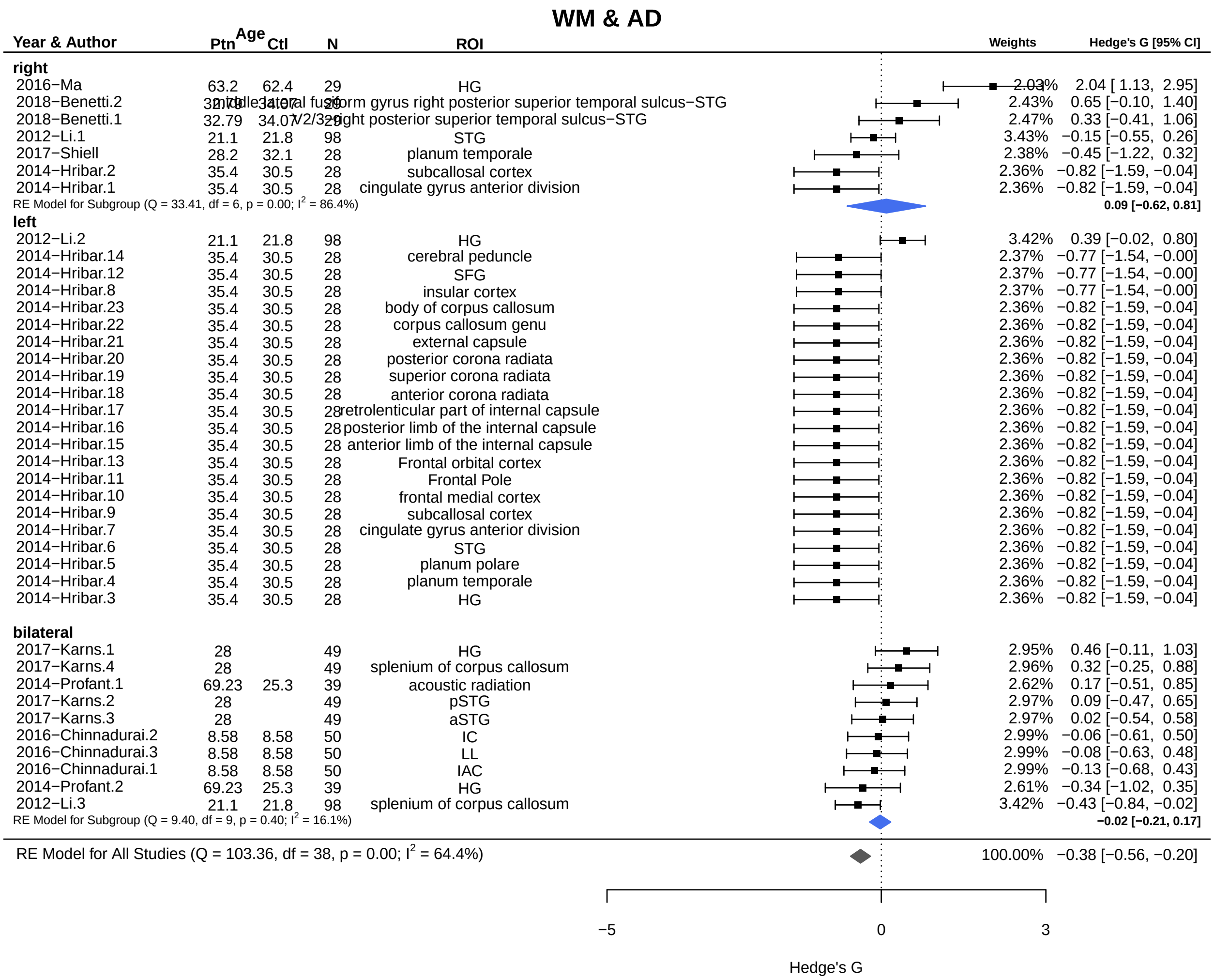
White matter: MD



White matter: Mean Kurtosis



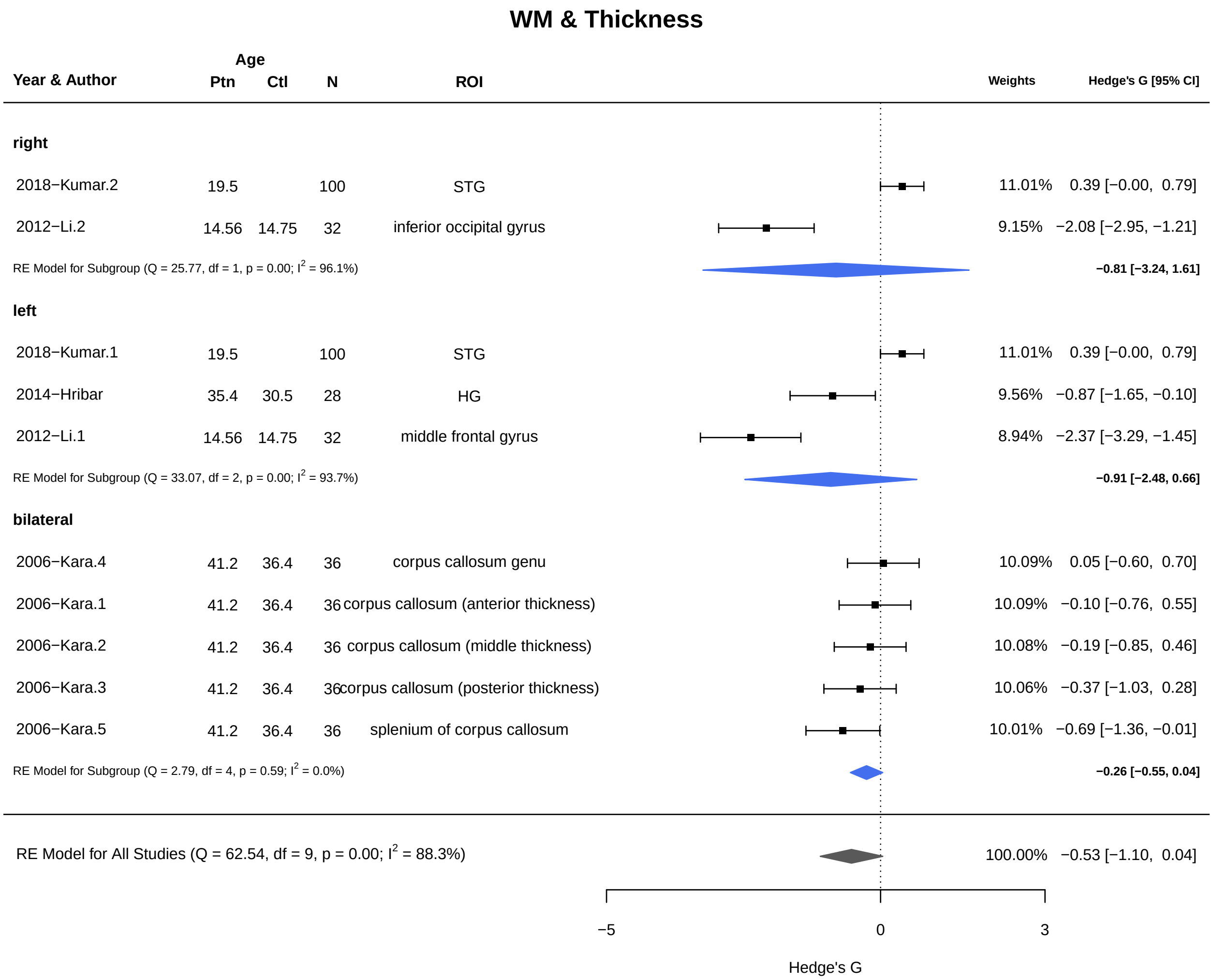
White matter: AD



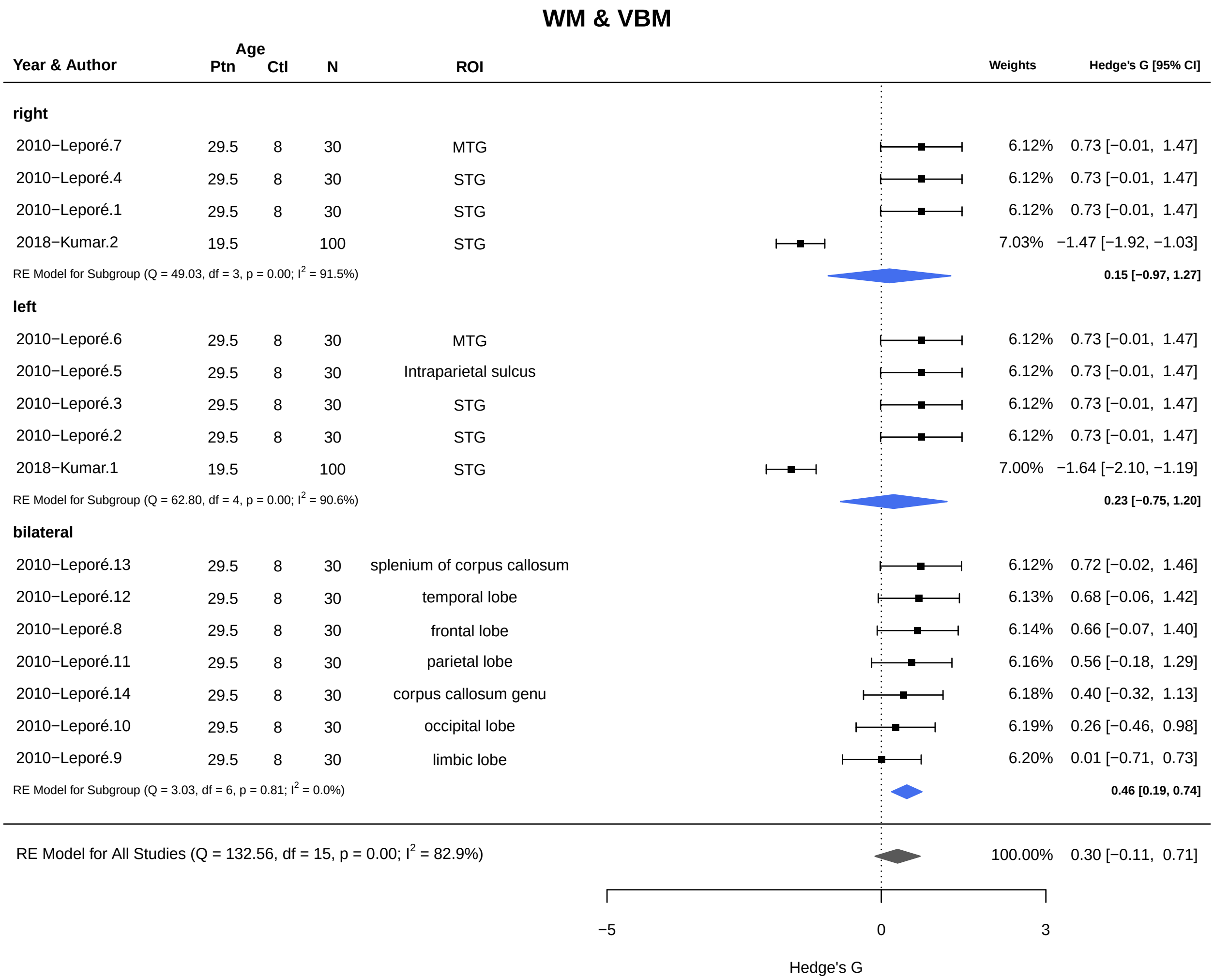
Error in rma(yi = hedgesG, vi = varG, data = meta.mod, measure = "MD", : Fisher scoring algorithm did not converge. See 'help(rma)' for possible remedies.

Other Measures of White Matter

White matter: Thickness



White matter: VBM



Meta Plots

The L'Abbé plot

In a L'Abbé plot (based on L'Abbé, Detsky, & O'Rourke, 1987), the arm-level outcomes for two experimental groups (e.g., treatment and control group) are plotted against each other. is treatment versus effect, since you have the cohen's d this should be relatively simple.
> WE DON'T HAVE TWO EXPERIMENTAL GROUPS

Baujat plot to identify studies contributing to heterogeneity

The plot shows the contribution of each study to the overall Q-test statistic for heterogeneity on the horizontal axis versus the influence of each study (defined as the standardized squared difference between the overall estimate based on a fixed-effects model with and without the ith study included in the model) on the vertical axis 2.17. Funnel plot to illustrate publication bias

Galbraith plot

Radial plot (radial) of variables and cohen's d - Galbraith, Rex (1988). "Graphical display of estimates having differing standard errors". Technometrics. Technometrics, Vol. 30, No. 3. 30 (3): 271–281.
2.18.2. We want to see this type of error plot over time for our patient cohorts by age. we want this for each measure WM and GM versus age on the x-axis so we can see GM and WM over time! Do a monte carlo simulation to connect different age population and create the error.
For a fixed-effects model, the plot shows the inverse of the standard errors on the horizontal axis against the individual observed effect sizes or outcomes standardized by their corresponding standard errors on the vertical axis. On the right hand side of the plot, an arc is drawn corresponding to the individual observed effect sizes or outcomes. A line projected from (0,0) through a particular point within the plot onto this arc indicates the value of the individual observed effect size or outcome for that point.

Resources

We are following Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines: Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., and Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 6:e1000097. doi: 10.1371/journal.pmed.1000097 AND https://www.bmj.com/content/339/bmj.b2535

- https://stackoverflow.com/questions/14426637/how-to-do-bubble-plot
- https://www.researchgate.net/publication/296680807_Menstrual_hygiene_management_among_adolescent_girls_in_India_A_Systematic_review_and_meta-analysis/figures?lo=1

Good explanation of some of the plots:

- https://ora.ox.ac.uk/objects/uuid:ff78831d-6f82-4187-97cc-349058e9abde/download_file?file_format=pdf&safe_filename=Rahimi%2Bet%2Bal%252C%2BData%2Bvisualisation%2Bfor%2Bmeta-analysis.pdf&type_of_work=Journal+article