

Supplementary Material

A comparative study of segmentation techniques for the quantification of brain subcortical volume

Authors Theophilus N. Akudjedu^{1*}, Leila Nabulsi¹, Migle Makelyte^{1,2}, Cathy Scanlon¹, Sarah Hehir¹, Helen Casey¹, Srinath Ambati¹, Joanne Kenney¹, Stefani O'Donoghue¹, Emma McDermott¹, Liam Kilmartin², Peter Dockery¹, Colm McDonald¹, Brian Hallahan¹, Dara M. Cannon¹.

Affiliations ¹Centre for Neuroimaging & Cognitive Genomics (NICOG), Clinical Neuroimaging Laboratory, NCBES Galway Neuroscience Centre, Psychiatry & Anatomy, School of Medicine, College of Medicine Nursing and Health Sciences, National University of Ireland Galway, H91TK33 Galway, Ireland.

²College of Engineering and Informatics, National University of Ireland Galway, H91TK33 Galway, Ireland.

Keywords Segmentation techniques, Stereology, subcortical structures, FreeSurfer, FSL-FIRST, volBrain

Corresponding Author

Theophilus N. Akudjedu

Centre for Neuroimaging & Cognitive Genomics (NICOG), Clinical Neuroimaging Laboratory, NCBES Galway Neuroscience Centre, Psychiatry & Anatomy, School of Medicine, College of Medicine Nursing and Health Sciences, National University of Ireland Galway, H91TK33 Galway, Ireland.

Email rasningo@gmail.com

Supplementary Tables

Table S1 Comparison of segmentation techniques (correlations) within the global sample

	Right Caudate (z, p)	Left Caudate (z, p)	Right Hippocampus (z, p)	Left Hippocampus (z, p)
<i>Stereology vs. FSL-FIRST</i>	1.75,0.080	1.77, 0.077	1.31,0.190	2.57,0.010
<i>Stereology vs. volBrain</i>	1.14,0.254	1.59,0.112	1.40,0.162	0.79,0.430
<i>Stereology vs. FreeSurfer</i>	0.74,0.459	0.74,0.459	1.57,0.116	0.15,0.881
<i>FSL-FIRST vs. volBrain</i>	2.89,0.004	3.35,<0.0001	2.73,0.006	3.42,<0.0001
<i>FSL-FIRST vs. FreeSurfer</i>	2.50,0.012	2.52,0.012	2.90,0.004	2.78,0.005
<i>FreeSurfer vs. volBrain</i>	0.41,0.682	0.85,0.395	0.18,0.857	0.65,0.516

Table S1 Fisher's *r*-to-*z* transformation was used to compare the partial correlation coefficients between techniques relative to manual segmentation

Table S2 Comparison of segmentation techniques (correlations) between patients and healthy controls relative to manual segmentation

	Right Caudate (z, p)	Left Caudate (z, p)	Right Hippocampus (z, p)	Left Hippocampus (z, p)
Stereology	0.93,0.352	1.80,0.072	1.59,0.112	2.65,0.008
FSL-FIRST	0.68,0.496	0.18,0.861	0.42,0.678	0.99,0.325
volBrain	2.98,0.003	1.93,0.005	1.72,0.085	3.12,0.002
FreeSurfer	1.74,0.081	0.57,0.565	0.80,0.425	2.25,0.025

Table S2 Fisher's r-to-z transformation was used to compare the partial correlation coefficients between patients and controls across the techniques

Supplementary Figures

Fig. S1 Scatterplots demonstrating values as assessed by manual segmentation in comparison to other techniques to assess consistency in the segmentation of the left caudate and hippocampus

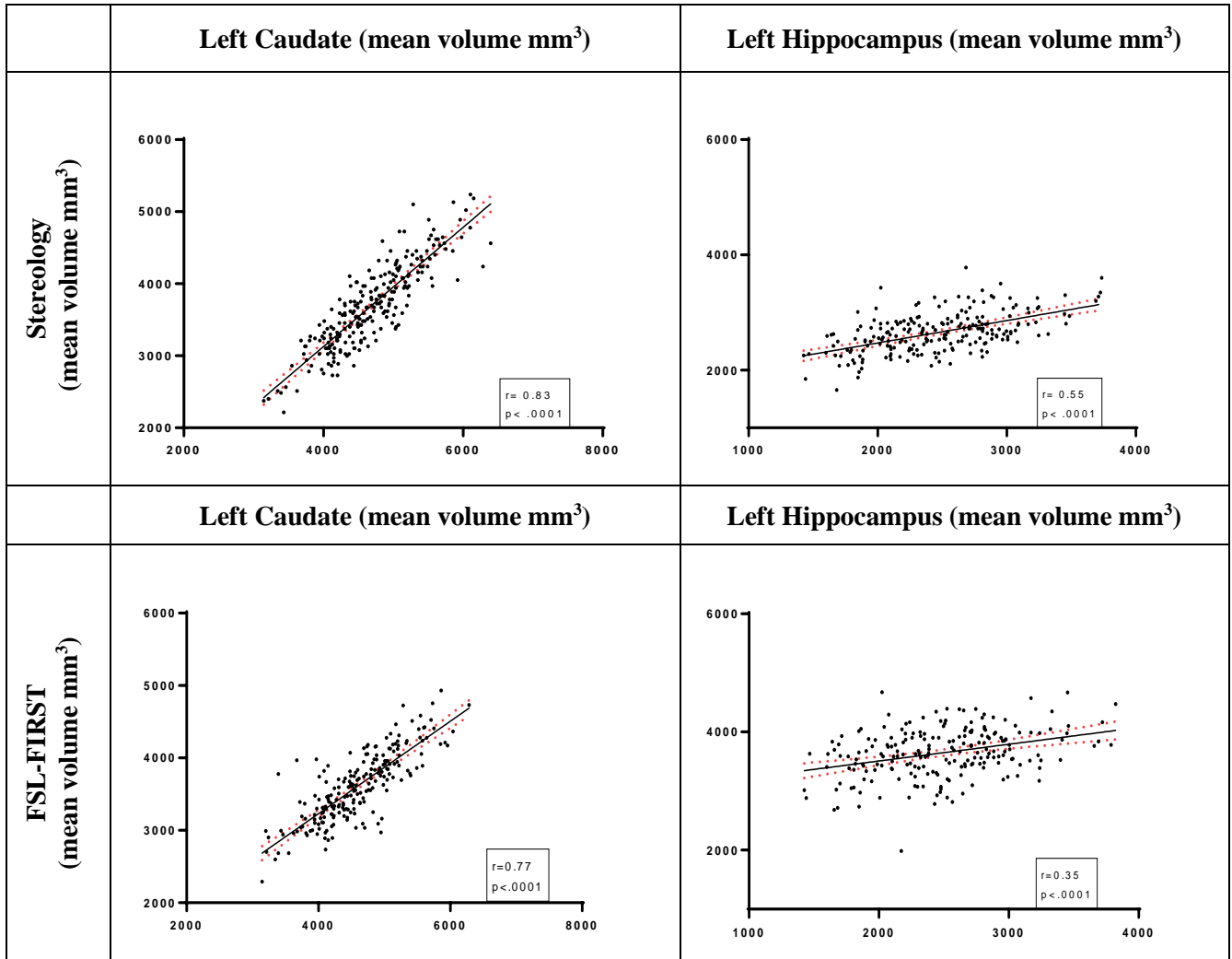


Fig. S1 The statistical values corresponding to the above correlations are presented in Table 1

Fig. S2 Scatterplots demonstrating values as assessed by manual segmentation in comparison to other techniques to assess consistency in the segmentation of the left caudate and hippocampus

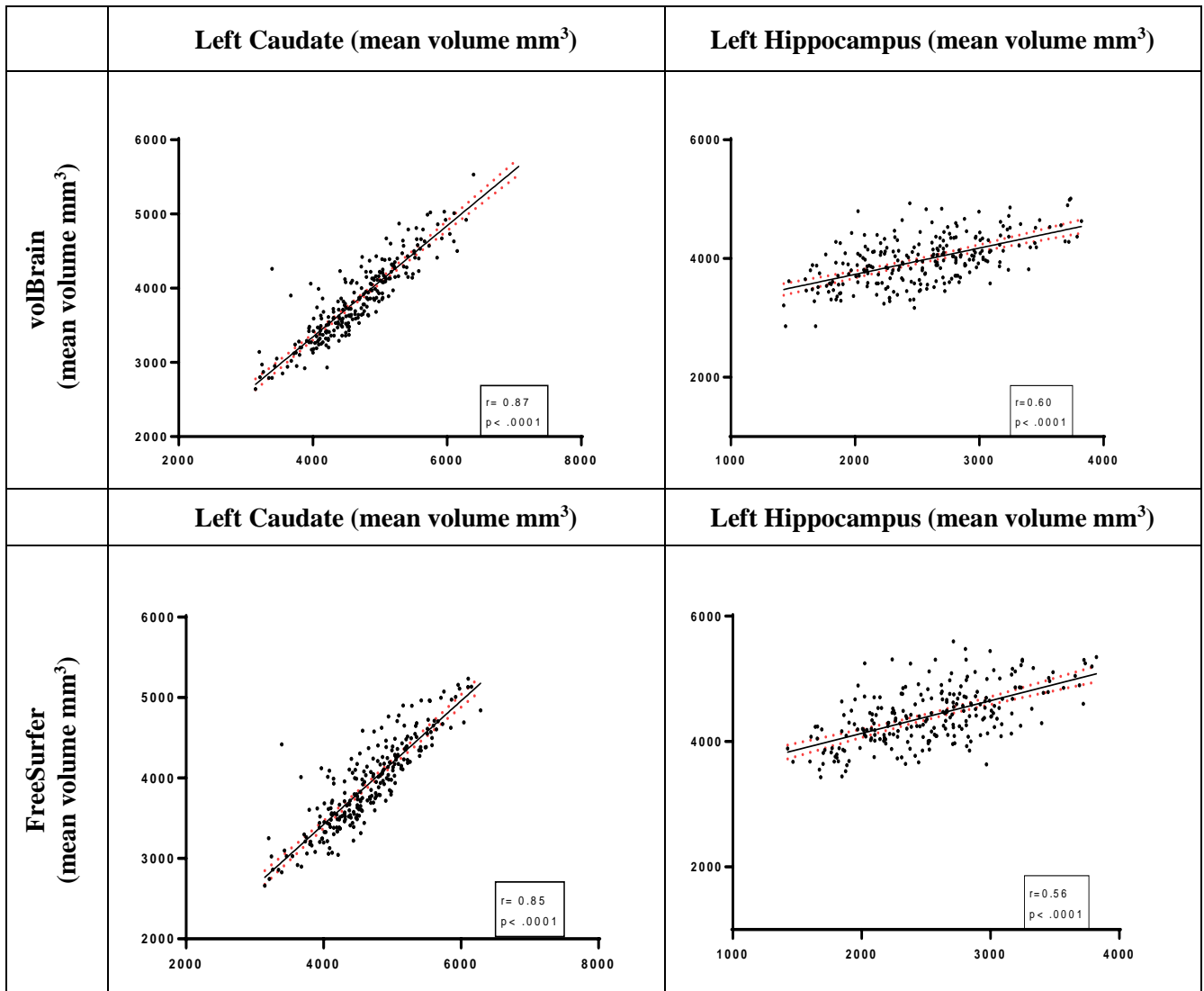


Fig. S2 The statistical values corresponding to the above correlations are presented in Table 1

Fig. S3 Orthogonal view of a subject showing the voxel misclassification of FreeSurfer at estimating the volume of the right hippocampus

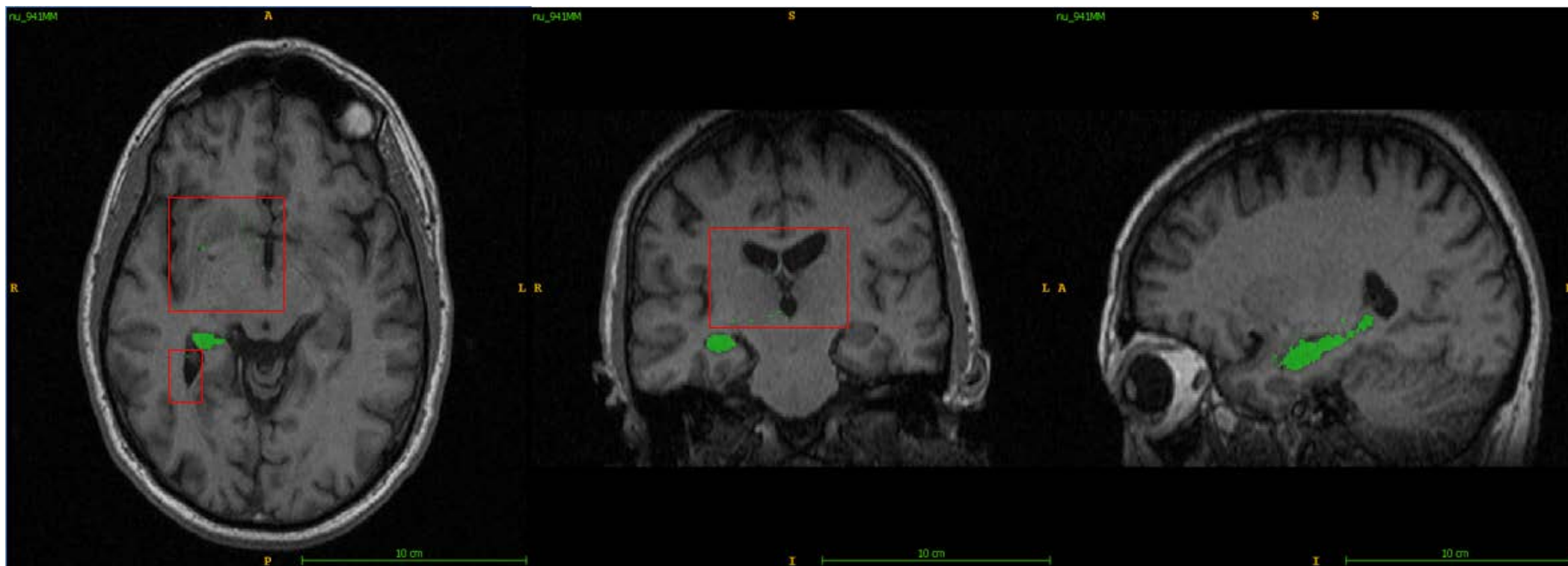


Fig. S3 The regions (in red) of highest voxel misclassification when estimating the volume of the hippocampus by FreeSurfer

Fig. S4 Left Caudate – Bland-Altman plots for bias estimation between manual segmentation and **A: Stereology**, **B: FSL**, **C: volBrain** and **D: FreeSurfer**

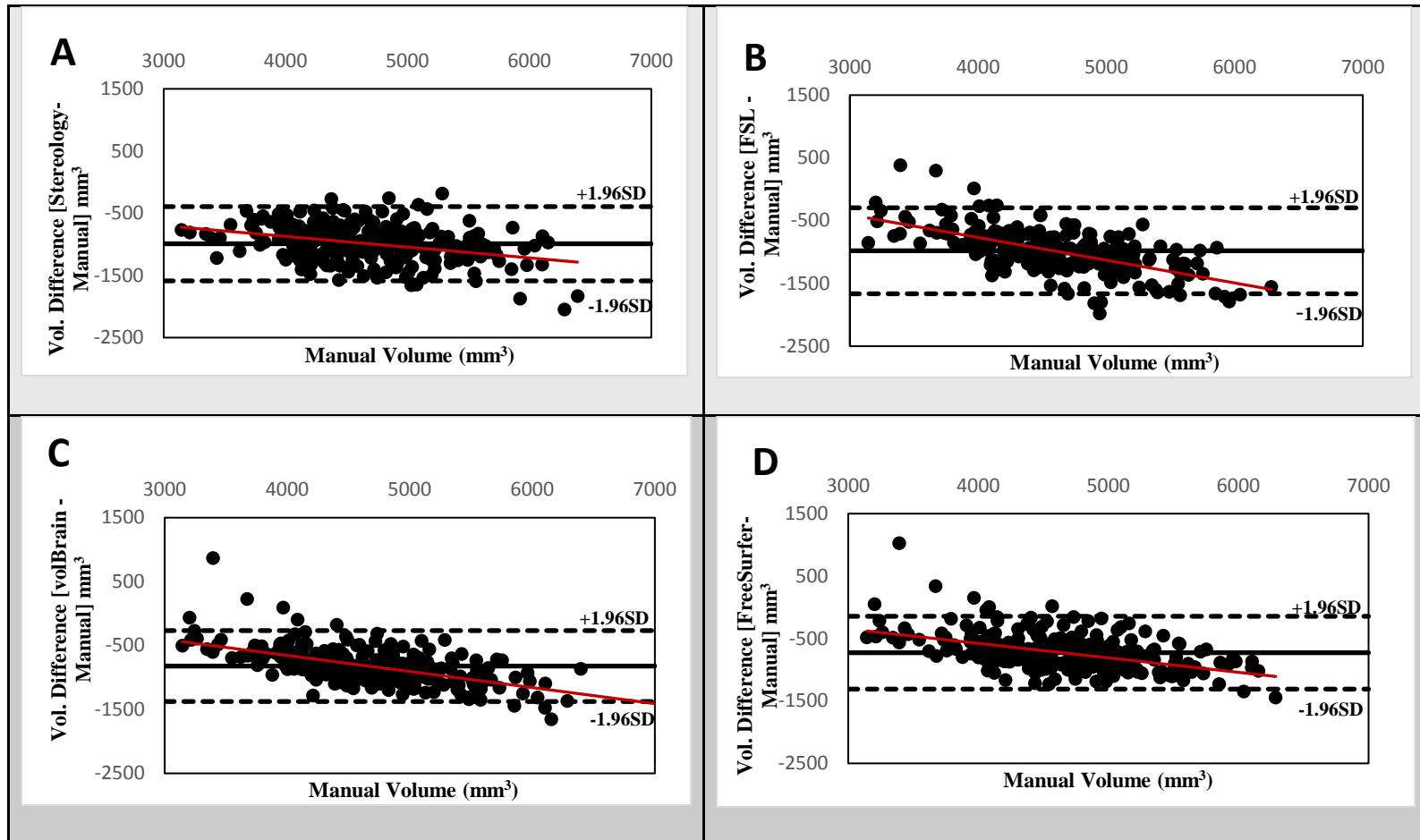


Fig. S4 The red regression lines were fit to show potential bias in volume estimation, the mean is represented with the continuous line while the lower (-1.96 x standard deviation) and upper limits (+1.96 x standard deviation) of agreement are represented with broken line

Fig. S5 Left Hippocampus – *Bland-Altman plots for bias estimation between manual segmentation and A: Stereology, B: FSL, C: volBrain and D: FreeSurfer*

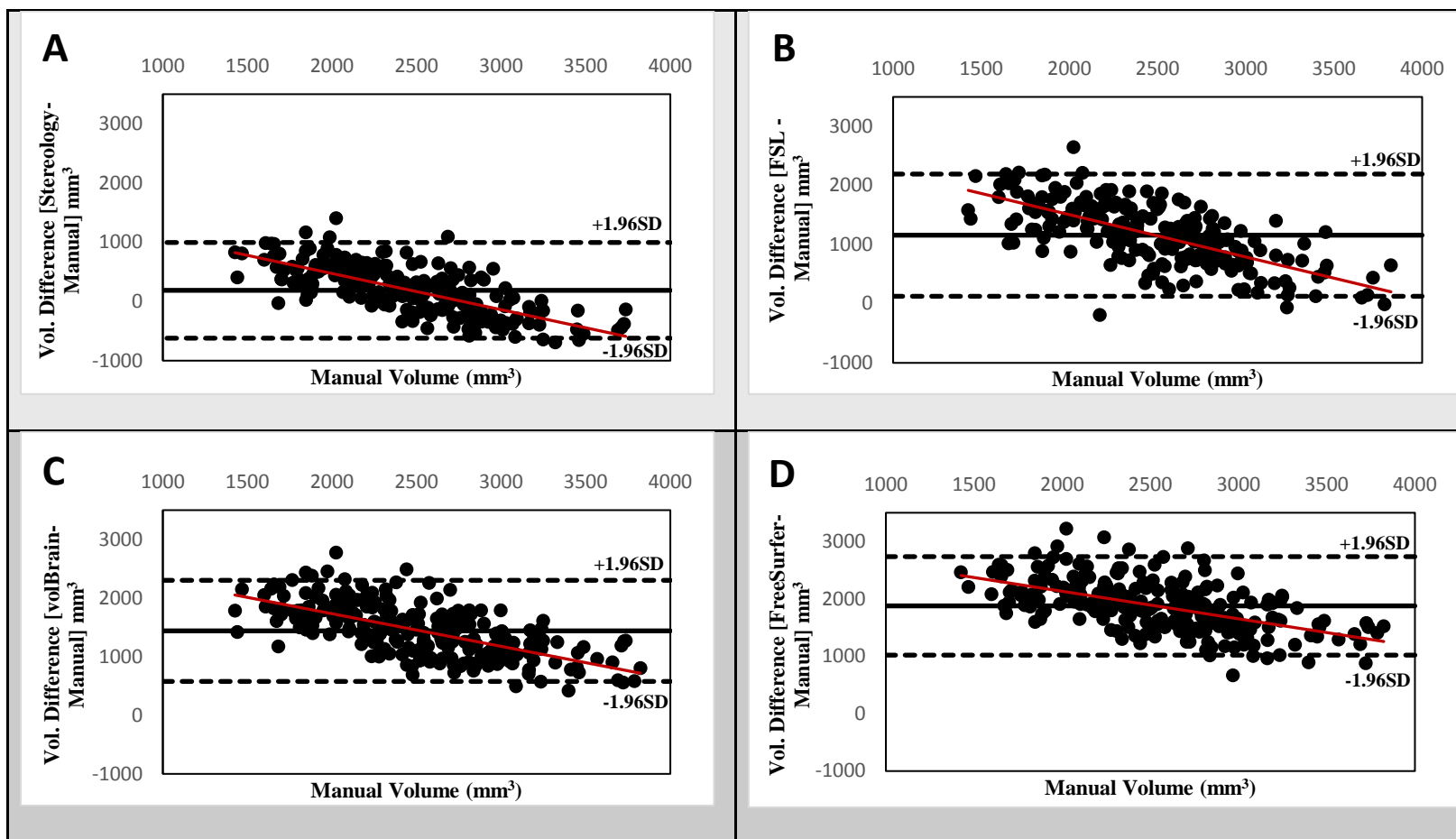


Fig. S5 The red regression lines were fit to show potential bias in volume estimation, the mean is represented with the continuous line while the lower (-1.96 x standard deviation) and upper limits (+1.96 x standard deviation) of agreement are represented with broken line