

Individual Variation of Human Cortical Structure Is Established in the First Year of Life

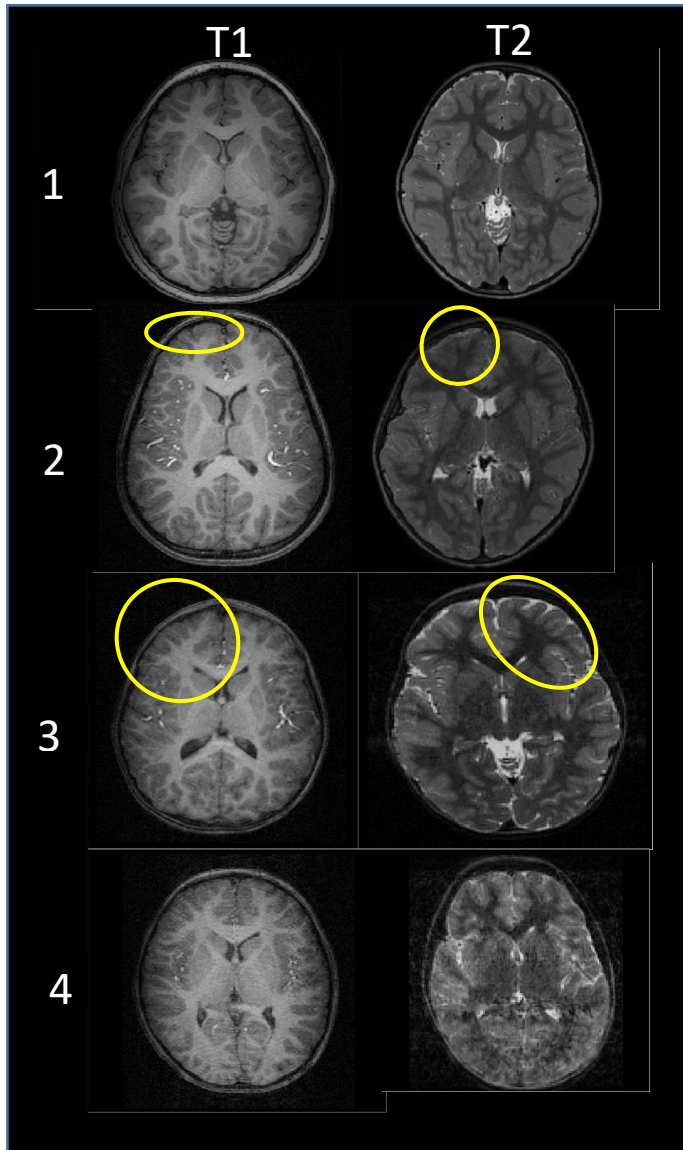
Supplement 1

Supplemental Methods

Image Acquisition

Proton density and T2 weighted structural images for neonates were acquired on the Allegra using a turbo-spin echo sequence (TSE, TR = 6200ms, TE1 = 20ms, TE2 = 119ms, flip angle = 150°, spatial resolution = 1.25mm x 1.25mm x 1.95mm, N = 166) or a “fast” turbo-spin echo sequence using a decreased TR, a smaller image matrix, and fewer slices (TSE, TR range = 5270ms-5690ms, TE1 range = 20ms-21ms, TE2 range = 119ms-124ms, flip angle = 150°, spatial resolution = 1.25mm x 1.25mm x 1.95mm, N = 189). For the Trio, participants were initially scanned using a TSE protocol (TR=6200ms, TE1=17, TE2=116ms, flip angle=150°, spatial resolution= 1.25mm x 1.25mm x 1.95 mm, N = 4) while the remainder were scanned using a 3DT2 SPACE protocol (TR=3200ms, TE=406, flip angle=120°, spatial resolution= 1mm x 1mm x 1mm, N=58).

T1 weighted images for neonates, 1, 2, 4 and 6 year olds were acquired on the Allegra using a 3D magnetization prepared rapid gradient echo sequence (MP-RAGE TR = 1880-1900ms, TE = 4.38ms, flip angle = 7°, spatial resolution = 1mm x 1mm x 1mm). T1 images on the Trio were collected using a lower echo time (MP-RAGE TR = 1860-1900ms, TE = 3.74ms, flip angle = 7°, spatial resolution = 1mm x 1mm x 1mm).



Supplemental Figure S1. Examples of motion scoring. T1 and T2 weighted images were rated for motion artifacts on a scale of 1 to 4, with 1 being the highest quality images with no to slight artifacts in a few slices and 4 being the lowest quality images with moderate to heavy artifacts in few to many slices. Images were rated by two raters with average inter-rater reliability = 97.5% and average intra-rater reliability = 87%. Rater scores were averaged. If scores differed by two or more points, raters met and a consensus score was generated.

	N		Motion Score		
	WM/GM (S/T)	CT/SA (S/T)	N (S/T)	Singleton	Twin
				Mean (SD)	Mean (SD)
Neo	181/157	-	181/157	2.85 (0.68)	2.66 (0.55)
Year 1	111/108	110/106	111/109	2.36 (0.65)	2.48 (0.56)
Year 2	70/80	70/79	70/80	2.29 (0.54)	2.17 (0.55)
Year 4	90/56	85/55	92/56	2.59 (0.95)	2.48 (0.93)
Year 6	90/56	88/55	90/56	2.29 (0.83)	2.28 (0.83)

Supplemental Table S1. Scan sample size and motion scores for singleton (S) and twin (T) cohorts

	Neonate	Year 1	Year 2	Year 4	Year 6
Neonate					
Year 1	5.94E-08				
Year 2	4.16E-08	0.41			
Year 4	4.15E-03	0.03	0.01		
Year 6	1.46E-09	0.33	0.93	3.17E-03	

Supplemental Table S2. Singleton cohort pairwise t-test comparison P-value for motion scores. Overall ANOVA: Chi-square statistic – 61.81, DF – 4, P-value – 1.21E-12

	Neonate	Year 1	Year 2	Year 4	Year 6
Neonate					
Year 1	0.02				
Year 2	5.28E-08	1.09E-03			
Year 4	0.08	0.96	4.91E-03		
Year 6	1.19E-04	0.05	0.36	0.08	

Supplemental Table S3. Twin cohort pairwise t-test comparison P-value for motion scores. Overall ANOVA: Chi-square statistic – 37.01, DF –4, P-value 1.80E-05

	Singleton				Twin			
	Data from scan included	Pre-Prisma Visit	Prisma Visit	No Visit	Data from scan included	Pre-Prisma Visit	Prisma Visit	No Visit
Neonate	181	252	0	0	157	182	0	0
Year 1	111	215	0	37	109	133	0	49
Year 2	70	178	0	74	80	113	0	69
Year 4	92	131	19	102	56	67	8	107
Year 6	90	97	29	121	56	61	20	99

Supplemental Table S4. Subject retention through the study. Imaging visits for singletons at 1 and 2 years are relatively reduced as the initial study of singletons was funded for neonatal imaging only; 1 and 2 year visits were developmental assessments only. Twins were recruited after the initial singletons were recruited. This analysis is focused on scans obtained before the Prisma scanner was installed at UNC. Many subjects were not lost to follow-up, but went on to have Prisma scans at older ages and are not included in this analysis.

		N	Mean (SD)	% change to 6 yrs	P/T-Stat/DF
Year 0	GM (mm ³)	181	204109 (23081)	212%	5.3E-57/83.23/52
	WM (mm ³)	181	157198 (17681)	104%	2.7E-47/53.87/52
Year 1	GM (mm ³)	111	507701 (46420)	25%	6.9E-33/28.35/51
	WM (mm ³)	111	223255 (25097)	43%	7.0E-35/31.18/51
	SA (mm ²)	110	69166 (5449)	29%	4.2E-37/36.35/49
	CT (mm)	110	3.39 (0.13)	-3.5%	2.8E-4/-3.91/49
Year 2	GM (mm ³)	70	575139 (51062)	11%	3.9E-15/12.60/38
	WM (mm ³)	70	266444 (25364)	20%	1.4E-18/16.12/38
	SA (mm ²)	70	80313 (5661)	11%	8.6E-19/16.36/38
	CT (mm)	70	3.31 (0.09)	-1.2%	0.01/2.89/38
Year 4	GM (mm ³)	90	624951 (55689)	1.8%	1.4E-6/5.40/57
	WM (mm ³)	90	301907 (28733)	6.1%	2.0E-20/14.23/57
	SA (mm ²)	85	86802 (6036)	2.9%	5.1E-05/4.40/54
	CT (mm)	85	3.34 (0.17)	-2%	0.04/-2.15/54
Year 6	GM (mm ³)	90	636558 (58850)		
	WM (mm ³)	90	320357 (30720)		
	SA (mm ²)	88	89339 (6494)		
	CT (mm)	88	3.27 (0.15)		

Supplemental Table S5. Change in GM volume, WM volume, average CT and total surface area from respective age to age 6 years. Data including all values at age 6 and one previous age were used to fit a linear mixed effects model with each of the four different measures as the outcome (only GM and WM when neonate was previous age). Covariates included in the model were an indicator variable for age (year 6 or previous age), gender, scanner, and motion score. In addition, a subject level random intercept was included. Reported p-values, t-statistic, and degrees of freedom are for the coefficient for the age indicator variable, which tests the null hypothesis that there is no difference between age 6 and the previous year for the given brain volume measure.

	GM Slope	WM Slope	P-Value	Test statistic	N
Year 0,1	303729.84	66195.50	4.06E-239	-83.79	217
Year 1,2	68541.65	44291.60	5.38E-08	-5.63	134
Year 2,4	25744.56	18570.18	3.99E-03	-2.91	126
Year 4,6	6036.73	9458.67	0.13	1.50	120

Supplemental Table S6. Comparison of cortical GM and WM slopes in the singleton cohort. The test statistic and p-value are for the interaction between GM and WM slope using a linear mixed effects model controlling for age at scan, gender, scanner, gestational age at birth, and motion score with a random intercept for each subject.

Supplemental Table S7. Regional means of CT (separate large Excel file)

Supplemental Table S8. Regional means of SA (separate large Excel file)

Supplemental Table S9. Regional means of CT – r squared (separate large Excel file)

	All		Male		Female	
	r ²	CI	r ²	CI	r ²	CI
Year 1	0.93	(0.89, 0.95)	0.94	(0.91, 0.96)	0.90	(0.86, 0.94)
Year 2	0.97	(0.96, 0.98)	0.97	(0.95, 0.98)	0.96	(0.94, 0.98)
Year 4	0.99	(0.99, 1.00)	0.99	(0.98, 0.99)	0.99	(0.98, 0.99)

Supplemental Table S10. Singleton cohort R-squared for regional means of CT at given year predicting regional means at 6 from a linear model using the group mean in each of the 148 cortical regions at the previous age as predictors of the group mean in each region at age 6 years.

Supplemental Table S11. Regional means of SA– r squared (separate large Excel file)

		Male		Female		Not Controlled	Brain Size Controlled
		N	Mean (SD)	N	Mean (SD)	P/T-Stat/DF	P/T-Stat/DF
Year 0	GM (mm ³)	87	210675 (24496)	94	198032 (19963)	1.20E-05/-4.51/176	0.95/0.07/175
	WM (mm ³)	87	163190 (17695)	94	151728 (15892)	7.66E-07/-5.13/176	0.17/-1.37/175
Year 1	GM (mm ³)	55	527235 (44022)	56	488515 (40627)	1.21E-05/-4.59/106	0.05/1.96/105
	WM (mm ³)	55	234799 (24652)	56	211917 (19973)	3.2E-07/-5.46/106	0.49/-0.70/105
	SA (mm ²)	55	71570 (5107)	55	66762 (4698)	2.5E-06/-4.99/105	0.59/-0.54/104
	CT (mm)	55	3.44 (0.13)	55	3.35 (0.13)	2.8E-03/-3.06/105	0.74/-0.34/104
Year 2	GM (mm ³)	41	591034 (49033)	29	552667 (45800)	3.37E-03/-3.05/65	0.48/-0.71/64
	WM (mm ³)	41	272946 (26990)	29	257250 (19880)	0.01/-2.52/65	0.83/0.22/64
	SA (mm ²)	41	81986 (5654)	29	77947 (4839)	0.01/-2.90/65	0.94/-0.08/64
	CT (mm)	41	3.32 (0.08)	29	3.28 (0.09)	0.02/-2.40/65	0.80/-0.25/64
Year 4	GM (mm ³)	40	653482 (52458)	50	602126 (47397)	2.38E-06/-5.06/85	0.27/1.11/84
	WM (mm ³)	40	316358 (28286)	50	290346 (23576)	8.62E-07/-5.31/85	0.90/-0.13/84
	SA (mm ²)	38	88812 (5928)	47	85176 (5676)	7.68E-04/-3.50/80	0.14/1.47/77
	CT (mm)	38	3.40 (0.16)	47	3.28 (0.15)	9.62E-04/-3.43/80	0.16/-1.41/77
Year 6	GM (mm ³)	38	670875 (49460)	52	611480 (52444)	8.41E-07/-5.32/85	1/-0.01/84
	WM (mm ³)	38	337501 (30392)	52	307830 (24450)	3.58E-06/-4.96/85	0.54/0.61/84
	SA (mm ²)	38	92663 (6500)	50	86813 (5281)	2.41E-05/-4.47/83	0.11/1.62/82
	CT (mm)	38	3.31 (0.15)	50	3.23 (0.14)	1.40E-05/-4.62/83	0.12/-1.59/82

Supplemental Table S12. Sex differences in cortical GM, WM, total SA and average CT (mean (SD)) at each age in singleton cohort. Test statistic is based on a linear model with scanner, age at scan, motion score; coefficient for gender is reported. For CT, the cube root of cortical GM plus WM was used to control for overall brain size. For SA, the sum of cortical GM and WM was used to control for overall brain size.

		Male Slope	Female Slope	P-Value	Test Statistic	N
Year 0,1	WM	70378	59364	1.95E-03	-3.22	217
	GM	316569	290513	5.66E-05	-4.28	217
Year 1,2	WM	41643	45286	0.30	1.05	134
	GM	70173	66370	0.40	-0.85	134
	SA	10930	11098	0.76	0.30	133
	CT	-0.09	-0.06	0.13	1.54	133
Year 2,4	WM	18089	16720	0.56	-0.59	126
	GM	29262	23927	0.10	-1.72	126
	SA	6463	7029	0.42	0.83	123
	CT	0.09	0.04	0.09	-1.78	123
Year 4,6	WM	10232	9222	0.39	-0.87	120
	GM	7452	5052	0.20	-1.30	120
	SA	2207	1908	0.72	-0.36	116
	CT	-0.03	-0.03	0.78	-0.28	116

Supplemental Table S13. Singleton cohort sex differences in growth trajectories of cortical GM, WM, SA and CT. The interaction between genders and age using a linear mixed effects model controlling for age at scan, scanner, gestational age at birth, and motion score with a random intercept for each subject is presented.

		Female			Male		
		r^2	CI	N	r^2	CI	N
Year 0	WM	0.36	(0.00, 0.83)	31	0.33	(0.00, 0.99)	21
	GM	0.60	(0.33, 0.86)	31	0.53	(0.01, 1.00)	21
Year 1	WM	0.74	(0.41, 0.95)	26	0.47	(0.04, 0.89)	25
	GM	0.96	(0.88, 0.99)	26	0.74	(0.31, 0.94)	25
	SA	0.92	(0.70, 0.99)	24	0.77	(0.42, 0.95)	25
	CT	0.21	(0.00, 0.78)	24	0.26	(0.01, 0.80)	25
Year 2	WM	0.58	(0.00, 1.00)	18	0.60	(0.07, 0.96)	22
	GM	0.74	(0.00, 1.00)	18	0.88	(0.46, 0.99)	22
	SA	0.90	(0.00, 1.00)	18	0.95	(0.79, 1.00)	22
	CT	0.63	(0.00, 1.00)	18	0.38	(0.00, 0.93)	22
Year 4	WM	0.79	(0.49, 0.95)	32	0.79	(0.41, 0.98)	23
	GM	0.86	(0.55, 0.97)	32	0.65	(0.15, 0.95)	23
	SA	0.82	(0.49, 0.98)	30	0.34	(0.01, 0.94)	22
	CT	0.19	(0.01, 0.67)	30	0.03	(0.00, 0.68)	22

Supplemental Table S14. Variance in cortical structure at age 6 accounted for by earlier ages in singleton females and males. Separate models predicted cortical GM, WM, CT, and SA for neonate, 1, 2, and 4 year scans using motion, scanner and age at scan in days as covariates. The residuals from these models were then used in a linear model to predict cortical GM and WM at age 6. Covariates in these models were birthweight, gestational age at birth, gender, mother's education (in years), height at six, weight at six, scanner for the age six scan, age in days for the age six scan, and motion score for the age six scan. A confidence interval for the partial r-squared was determined from 1,000 bootstrap samples using the percentile method.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
Neonate	181									
GM		23.01	7.82	2.66E-11	644.28	3.81	3.52E-03	-403.9	-1.04	0.37
WM		16.11	6.45	2.94E-08	350.15	2.44	0.05	32.75	0.10	0.96
1 year	111									
GM		33.86	3.00	0.02	-614.01	-0.92	0.42	2617.06	1.78	0.14
WM		21.08	3.72	4.16E-03	-370.41	-1.10	0.35	1840.95	2.50	0.05
2 year	70									
GM		39.46	2.47	0.05	-1282.35	-1.39	0.25	2444.85	0.99	0.39
WM		19.09	2.53	0.05	-930.40	-2.14	0.09	1819.96	1.56	0.20
4 year	89									
GM		52.98	3.70	4.16E-03	-1622.74	-1.94	0.11	3014.02	1.39	0.25
WM		26.25	3.51	0.01	-834.94	-1.91	0.12	1519.6	1.34	0.26
6 year	89									
GM		53.73	3.22	0.01	-470.18	-0.49	0.67	4645.83	2.04	0.10
WM		24.85	2.91	0.02	-627.18	-1.28	0.28	3079.96	2.63	0.04

Supplemental Table S15. Relationship of birthweight, gestational age at birth, and maternal education with cortical GM and WM volumes in singleton cohort. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
1 year	110									
CT		3.66E-05	1.09	0.35	-2.15E-03	-1.09	0.35	9.50E-03	2.18	0.08
SA		3.86	2.95	0.02	-47.73	-0.62	0.59	360.53	2.12	0.09
2 year	70									
CT		7.23E-05	2.82	0.03	-2.92E-03	-1.98	0.11	6.69E-03	1.69	0.16
SA		4.13	2.32	0.06	-122.05	-1.19	0.32	213.99	0.78	0.51
4 year	84									
CT		9.26E-05	2.49	0.05	1.16E-04	0.06	0.97	9.93E-04	0.19	0.90
SA		3.91	2.34	0.06	-127.93	-1.37	0.26	400.79	1.69	0.16
6 year	87									
CT		6.11E-05	1.90	0.12	2.61E-05	0.01	0.99	8.14E-03	1.86	0.12
SA		5.51	2.95	0.02	-73.57	-0.68	0.56	421.86	1.65	0.17

Supplemental Table S16. Relationship of birthweight, gestational age at birth, and maternal education with average CT and total SA in singleton cohort. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
Neonate	181									
GM		3.29	2.03	0.50	231.09	2.80	0.31	-384.40	-2.08	0.50
WM		-1.70	-0.71	0.86	0.02	0.00	1.00	49.28	0.31	0.90
1 year	111									
GM		-7.62	-1.85	0.50	234.39	1.02	0.76	-567.56	-1.11	0.76
WM		1.37	0.50	0.84	32.80	0.21	0.95	327.46	0.95	0.76
2 year	70									
GM		4.98	1.00	0.76	500.57	1.76	0.50	-1476.23	-1.95	0.50
WM		4.11	1.09	0.76	-155.78	-0.72	0.81	116.36	0.20	0.95
4 year	89									
GM		-1.57	-0.38	0.88	19.09	0.08	0.99	-348.86	-0.59	0.83
WM		-1.60	-0.57	0.83	3.29	0.02	1.00	-197.32	-0.50	0.84
6 year	89									
GM		-0.69	-0.14	0.98	594.84	2.17	0.50	-959.06	-1.42	0.61
WM		-2.41	-0.76	0.81	-93.73	-0.55	0.83	265.53	0.63	0.83

Supplemental Table S17. Relationship of birthweight, gestational age at birth, and maternal education with GM and WM in the singleton cohort controlling for ICV at each age. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
1 year	110									
CT		-3.08E-05	-0.99	0.76	-7.69E-04	-0.45	0.86	4.32E-03	1.12	0.76
SA		-0.86	-1.51	0.60	49.33	1.56	0.59	-3.29	-0.05	1.00
2 year	70									
CT		3.17E-05	1.66	0.55	-8.26E-04	-0.76	0.81	2.07E-03	0.71	0.81
SA		0.40	0.57	0.83	70.97	1.77	0.50	-210.52	-1.98	0.50
4 year	84									
CT		5.20E-05	1.46	0.61	1.46E-03	0.77	0.81	-3.24E-03	-0.68	0.81
SA		-0.74	-1.03	0.76	29.53	0.77	0.81	93.68	0.97	0.76
6 year	87									
CT		2.75E-06	0.10	0.99	1.42E-03	0.91	0.76	1.40E-03	0.37	0.88
SA		0.30	0.29	0.90	50.97	0.91	0.76	-180.29	-1.32	0.68

Supplemental Table S18. Relationship of birthweight, gestational age at birth, and maternal education with CT and SA in the singleton cohort controlling for ICV at each age. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
Neonate	92									
GM		23.16	4.35	3.85E-05	549.95	2.43	0.02	-525.16	-1.07	0.29
WM		15.00	3.20	1.91E-03	304.94	1.53	0.13	-28.48	-0.07	0.95
1 year	65									
GM		6.62	0.47	0.64	-1600.67	-1.94	0.06	3596.35	2.07	0.04
WM		4.98	0.71	0.48	-669.40	-1.61	0.11	2128.93	2.44	0.02
2 year	43									
GM		65.89	2.61	0.01	-2501.89	-1.92	0.06	6023.12	1.57	0.13
WM		36.11	3.46	1.44E-03	-1493.50	-2.78	0.01	3921.19	2.46	0.02
4 year	80									
GM		51.48	3.47	8.95E-04	-1678.13	-1.86	0.07	4576.64	1.89	0.06
WM		24.18	3.16	2.32E-03	-690.40	-1.48	0.14	2095.85	1.68	0.10
6 year	85									
GM		54.98	3.16	2.24E-03	-528.60	-0.53	0.60	4717.60	1.96	0.05
WM		25.04	2.82	0.01	-637.28	-1.24	0.22	3285.12	2.67	0.01

Supplemental Table S19. Relationship of birthweight, gestational age at birth, and maternal education with GM and WM in the singleton cohort controlling for height at each age. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

	N	Birthweight			Gest Age @ Birth			Maternal Education		
		Coef	T-stat	P value	Coef	T-stat	P value	Coef	T-stat	P value
1 year	64									
CT		-1.14E-05	-0.25	0.80	-2.02E-03	-0.77	0.45	1.18E-02	2.12	0.04
SA		0.63	0.42	0.67	-157.22	-1.78	0.08	413.65	2.24	0.03
2 year	43									
CT		1.07E-04	2.61	0.01	-4.50E-03	-2.13	0.04	1.26E-02	2.01	0.05
SA		7.53	2.89	0.01	-241.14	-1.80	0.08	645.73	1.63	0.11
4 year	76									
CT		9.24E-05	2.54	0.01	1.03E-04	0.05	0.96	2.16E-03	0.38	0.71
SA		4.09	2.43	0.02	-159.78	-1.62	0.11	599.20	2.27	0.03
6 year	83									
CT		6.38E-05	1.94	0.06	-3.90E-04	-0.20	0.84	8.86E-03	1.95	0.05
SA		5.50	2.84	0.01	-67.17	-0.59	0.56	403.16	1.50	0.14

Supplemental Table S20. Relationship of birthweight, gestational age at birth, and maternal education with CT and SA in the singleton cohort controlling for height at each age. The model included each variable, with age at scan, scanner and motion as controls. P values were FDR corrected for analysis of GM and WM volume, average CT and total SA.

		GM (mm ²)	WM (mm ³)	N	Total SA (mm ²)	Mean CT (mm)	N
Year 0	All	198449 (24120)	154747 (18851)	157			
	Males	201087 (22056)	157339 (16570)	86			
	Females	195254 (26209)	151606 (20982)	71			
	P-value	5.59E-04	1.27E-04				
	T-Stat	-3.53	-3.93				
	DF	152	152				
Year 1	All	504089 (46359)	227124 (25845)	108	68455 (5437)	3.40 (0.12)	106
	Males	523618 (42188)	238125 (23848)	57	70567 (5102)	3.43 (0.10)	56
	Females	482263 (41049)	214830 (22369)	51	66088 (4827)	3.37 (0.12)	50
	P-value	4.30E-06	1.58E-06		0.48	0.22	
	T-Stat	-4.86	-5.10		0.72	-1.25	
	DF	103	103		99	99	
Year 2	All	564260 (50199)	264017 (28673)	80	78755 (5976)	3.28 (0.10)	79
	Males	582930 (40594)	271965 (26060)	43	80616 (5048)	3.30 (0.10)	43
	Females	542561 (52030)	254781 (29131)	37	76532 (6299)	3.25 (0.10)	36
	P-value	6.09E-04	0.02		0.23	0.27	
	T-Stat	-3.58	-2.35		1.20	-1.12	
	DF	75	75		73	73	
Year 4	All	632399 (53774)	309541 (27999)	56	87984 (5940)	3.29 (0.12)	55
	Males	651250 (47692)	317397 (24789)	33	89953 (5305)	3.30 (0.13)	32
	Females	605351 (51213)	298270 (28995)	23	85244 (5785)	3.27 (0.11)	23
	P-value	1.31E-03	0.01		0.81	0.97	
	T-Stat	-3.40	-2.52		-0.24	0.04	
	DF	51	51		49	49	
Year 6	All	627908 (60109)	320701 (34237)	56	89178 (6982)	3.23 (0.11)	55
	Males	649463 (54877)	330332 (31351)	29	91912 (6751)	3.24 (0.10)	29
	Females	604756 (57665)	310356 (34736)	27	86129 (5994)	3.22 (0.12)	26
	P-value	0.01	0.04		0.10	0.70	
	T-Stat	-2.80	-2.07		-1.66	0.39	
	DF	51	51		49	49	

Supplemental Table S21. Twin cohort mean (SD) for WM, GM, SA and CT at given age for all, males and females. Test statistic based on linear model with scanner, age at scan, motion score; coefficient for gender is reported. For cortical thickness (CT), the cube root of cortical GM plus WM was used to control for overall brain size. For surface area (SA) the sum of cortical GM and WM was used to control for overall brain size.

Supplemental Table S22. Regional means of CT for Twins

Supplemental Table S23. Regional means of SA for Twins

Supplemental Table S24. Abbreviations for cortical regions (separate large Excel file)

		Singletons			Twins		
		r^2	CI	N	r^2	CI	N
Year 0	WM	0.50	(0.14, 0.79)	36	0.29	(0.08, 0.62)	42
	GM	0.54	(0.17, 0.79)	36	0.43	(0.22, 0.70)	42
Year 1	WM	0.63	(0.30, 0.87)	35	0.60	(0.38, 0.76)	46
	GM	0.86	(0.72, 0.94)	35	0.84	(0.71, 0.94)	46
	SA	0.86	(0.73, 0.94)	35	0.74	(0.52, 0.90)	44
	CT	0.02	(0.00, 0.35)	35	0.37	(0.05, 0.76)	44
Year 2	WM	0.69	(0.34, 0.92)	29	0.68	(0.43, 0.86)	37
	GM	0.86	(0.61, 0.97)	29	0.86	(0.68, 0.94)	37
	SA	0.93	(0.85, 0.99)	29	0.78	(0.51, 0.91)	35
	CT	0.39	(0.01, 0.79)	29	0.61	(0.25, 0.88)	35
Year 4	WM	0.83	(0.60, 0.95)	41	0.94	(0.86, 0.98)	30
	GM	0.84	(0.65, 0.96)	41	0.93	(0.78, 0.98)	30
	SA	0.61	(0.32, 0.91)	41	0.92	(0.75, 0.98)	28
	CT	0.00	(0.00, 0.18)	41	0.57	(0.18, 0.86)	28

Supplemental Table S25. Partial r squared values from model with subjects with minor bleeds on neonatal MRI excluded.

		Twins 33 week gest age cutoff			Twins 37 week gest age cutoff		
		r^2	CI	N	r^2	CI	N
Year 0	WM	0.27	(0.05, 0.58)	45	0.53	(0.01, 1.00)	21
	GM	0.45	(0.22, 0.69)	45	0.64	(0.01, 1.00)	21
Year 1	WM	0.61	(0.41, 0.77)	48	0.69	(0.05, 1.00)	22
	GM	0.81	(0.64, 0.93)	48	0.92	(0.69, 1.00)	22
	SA	0.73	(0.52, 0.88)	46	0.68	(0.03, 1.00)	22
	CT	0.37	(0.08, 0.76)	46	0.45	(0.01, 1.00)	22
Year 2	WM	0.7	(0.49, 0.87)	40	0.79	(0.00, 1.00)	17
	GM	0.83	(0.65, 0.93)	40	0.93	(0.00, 1.00)	17
	SA	0.78	(0.53, 0.90)	38	0.78	(0.00, 1.00)	17
	CT	0.59	(0.31, 0.85)	38	0.72	(0.00, 1.00)	17
Year 4	WM	0.93	(0.85, 0.98)	32	0.96	(0.00, 1.00)	15
	GM	0.97	(0.93, 0.99)	32	0.84	(0.00, 1.00)	15
	SA	0.93	(0.85, 0.98)	30	0.88	(0.00, 1.00)	15
	CT	0.55	(0.20, 0.86)	30	0.62	(0.00, 1.00)	15

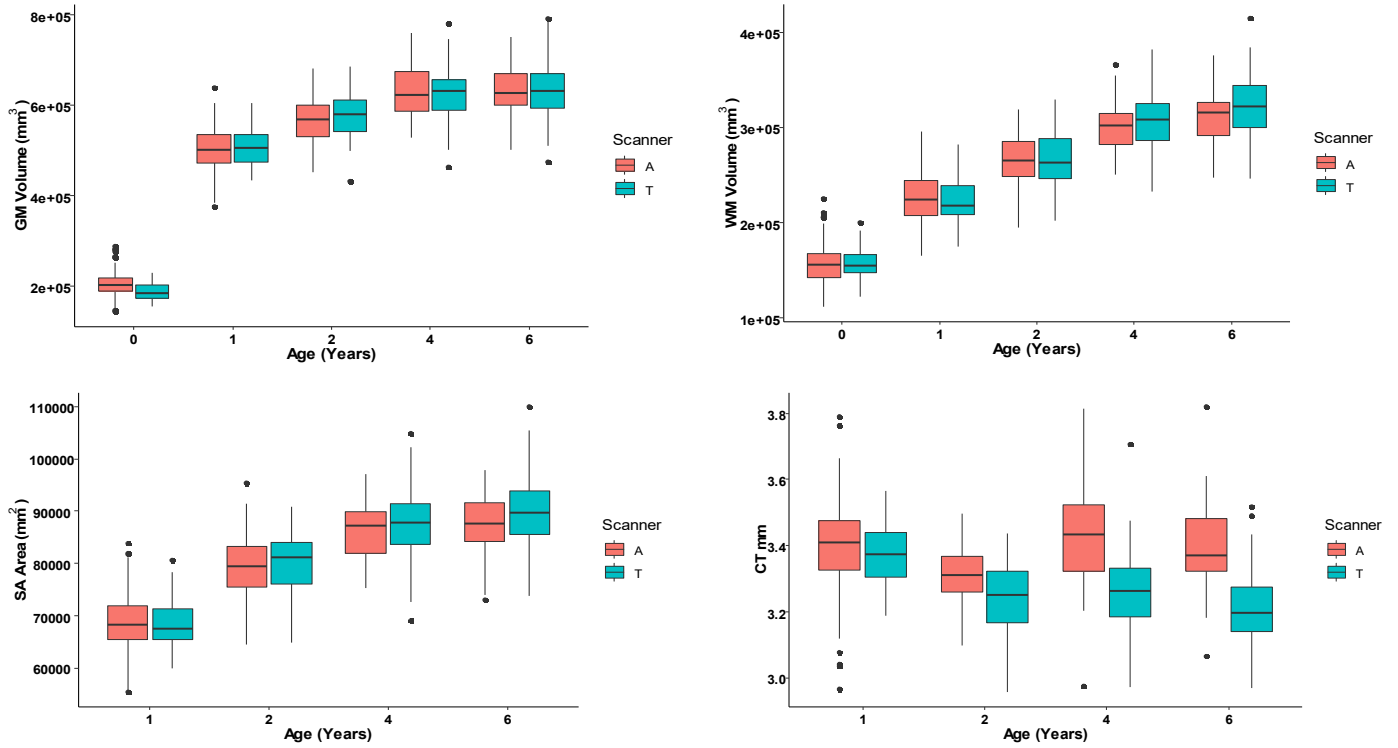
Supplemental Table S26. Partial r squared values comparing 37 and 33 week gestational age at birth exclusions for twins. While r^2 values are similar, confidence intervals are not as informative in the less than 37 week group due to smaller sample size.

		Singletons			Twins		
		r ²	CI	N	r ²	CI	N
Year 0	WM	0.21	(0.00, 1.00)	19	0.61	(0.19, 0.86)	27
	GM	0.59	(0.00, 1.00)	19	0.37	(0.02, 0.77)	27
Year 1	WM	0.42	(0.06, 0.88)	26	0.78	(0.45, 0.96)	24
	GM	0.81	(0.52, 0.95)	26	0.92	(0.71, 0.98)	24
	SA	0.81	(0.47, 0.96)	25	0.86	(0.56, 0.99)	24
	CT	0.39	(0.02, 0.84)	25	0.41	(0.00, 0.89)	24
Year 2	WM	0.69	(0.26, 0.93)	26	0.77	(0.41, 0.96)	26
	GM	0.78	(0.43, 0.95)	26	0.91	(0.75, 0.98)	26
	SA	0.87	(0.66, 0.96)	26	0.91	(0.75, 0.98)	25
	CT	0.19	(0.00, 0.74)	26	0.71	(0.23, 0.93)	25
Year 4	WM	0.92	(0.65, 0.99)	24	0.93	(0.00, 1.00)	15
	GM	0.97	(0.78, 1.00)	24	0.71	(0.00, 1.00)	15
	SA	0.92	(0.54, 0.99)	23	0.56	(0.00, 1.00)	15
	CT	0.04	(0.00, 0.88)	23	0.80	(0.00, 1.00)	15

Supplemental Table S27. Partial r squared values in only subjects with an average motion score less than or equal to 2.5.

	GM	WM	CT	SA
Neo	8.83E-09	0.34	-	-
Year 1	0.84	0.20	0.35	0.77
Year 2	0.34	0.84	0.12	0.64
Year 4	0.33	0.08	1.83E-04	0.20
Year 6	0.84	0.27	8.83E-09	0.27

Supplemental Table S28. FDR corrected p-values for differences in GM volume, WM volume, average CT, and total SA between Allegra and Trio scanners controlling for gender, gestational age at birth, birthweight, mother's education, and age at scan.



Supplemental Figure S2. Mean GM volume, WM volume, average CT, and total SA in subjects scanned on Allegra and Trio scanners controlling for gender, gestational age at birth, birthweight, mother's education, and age at scan.