Genetic Architecture of Reciprocal Social Behavior in Toddlers: Implications for Heterogeneity in the Early Origins of Autism Spectrum Disorder

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SUPPLEMENTAL MATERIAL

Results

Statistics comparing the California (CA) site to the Missouri (MO) site in the ERSB study are as follows: lower mean RSB total scores for MO ($t(712)=-2.19$, $p<.001$), older age at assessment for MO ($t(528)=11.81$, $p<.001$), more child medical problems in MO ($t(459)=6.66$, $p<.001$), a lower percentage of Hispanics in MO ($\chi^2(1)=618.15$, $p=.053$), a higher percentage of African-American race ($\chi^2(1)=36.59$, $p<.001$), a higher proportion of mothers with college degrees ($\chi^2(1)=52.66$, $p<.001$), and a higher proportion of maternal tobacco use in MO ($\chi^2(1)=26.33$, $p<.001$).

Levels for income terciles by study and study site are as follows: ICD: low - ≤$74999/year; middle - $75000-$149999/year; high - ≥$150000/year; MO ERSB site: low - ≤$59999/year; middle - $60000-$89999/year; high - ≥$90000/year; and CA ERSB Site: low - ≤$59999/year; middle - $60000-$119999/year; high - ≥$120000/year.

Supplemental Table 1. Sample Comparisons			
Variable	Nonsample (n=2,873 pairs)	Sample (n=201 pairs)	Statistic
Age of Mother	29.34 (6.27)	30.55 (5.80)	t(2925)=2.65, p=0.008
Age of Father	31.65 (7.22)	32.81 (7.08)	t(2683)=2.19, p=0.03
Mother's Education	3.61 (1.67)	4.90 (1.51)	t(2811)=9.14, p<0.001
Father's Education	3.42 (1.69)	4.55 (1.66)	t(2551)=7.79, p<0.001
Father's Race			
Multiracial	4.0%	8.2%	$\chi^2(7)=19.70$, p<0.006
Other	3.9%	0.7%	
Unknown	8.3%	2.%	
Payment for Prenatal Care			
Private Insurance	41.0%	67.1%	$\chi^2(2)= 47.20$, p<0.001
Government Program	57.5%	28.8%	
Self-Pay	1.8%	4.1%	
Government Assistance	66.8%	40.0%	$\chi^2(1)=43.76$, p<0.001
Foreign Born Mother	40.9%	12.3%	χ^2 (1)=47.15, p<0.001
Nonsample data are from all Hispanic families living with twins in the California site born between January 1, 2012 and December 31, 2012. Sample data are from the families who matriculated through data collection at the California site.			

Supplemental Table 2. Sociodemographic Factors in Relationship to 18-month RSB

Parameter	B	SE	95% CI	Wald $\chi^2(1)$	Sig.
(Intercept)	13.35	7.83	-2.00, 28.70	2.91	.088
Assessment Age (months)	.20	.43	-.65, 1.05	.22	.64
Sex	-3.35	.75	-4.82, -1.88	19.91	<.001
Ethnicity	.84	.84	-.81, 2.49	.99	.32
Maternal Education	-2.94	.88	-4.68, -1.21	11.12	.001
Middle Income	-1.85	.98	-3.78, .082	3.52	.061
High Income	-2.46	.93	-4.28, -.63	6.96	.008
(Scale)	98.50				

Parameter estimates are derived from a generalized linear model that clustered for twin family and used a robust sandwich variance estimator to account for non-independence of twins. Sex and high income show negative associations with 18-month RSB, whereby female sex and higher income correspond to lower RSB score and greater RSB competence. RSB=reciprocal social behavior. SE=standard error. CI= confidence interval.

Supplemental Table 3. Significant Sociodemographic and Medical Factors Related to 18-month RSB

Parameter	B	SE	T	Significance	95% CI
Constant	45.68	6.18	7.39	<.001	23.68, 46.30
Sex	-3.27	.73	-4.47	<.001	-4.69, -1.85
Maternal Education	-4.15	.80	-5.15	<.001	-5.70, -2.59
Gestational Age (weeks)	-.46	.16	-2.80	.0053	-.78, -.14
Child Medical Problems	1.62	.78	2.08	.037	.15, 3.08

Here a linear regression model, with SE (standard error) adjusted for non-independence of twins using a robust sandwich variance estimator, was generated specifically for sociodemographic and medical variables shown to have significant effects on 18-month RSB. This model was significant ($F(4, 699)=12.22$, $p<.001$) and accounted for 9.4% of the variance in RSB. RSB=reciprocal social behavior. SE= standard error. CI= Confidence Interval.

Supplemental Table 4. Bivariate ACE Models for RSB Factors at Ages 18 and 24 months

	18-months			24-months		
	Additive Genetic	Shared Environment	Nonshared Environment	Additive Genetic	Shared Environment	Nonshared Environment
Social Motivation (F1-SM)	0.73 (0.58, 0.83)	0.09 (0.01, 0.22)	0.18 (0.14, 0.24)	0.74 (0.59, 0.84)	0.08 (0.01, 0.22)	0.17 (0.13, 0.24)
Functional Communication (F2-SM)	0.76 (0.57, 0.87)	0.10 (0.01, 0.29)	0.14 (0.11, 0.18)	0.67 (0.45, 0.81)	0.12 (0.01, 0.32)	0.21 (0.16, 0.28)
Restricted, Repetitive Interests and Behavior (F3-RRB)	0.46 (0.37, 0.54)	0.25 (0.19, 0.32)	0.29 (0.23, 0.36)	0.82 (0.76, 0.86)	---	0.18 (0.14, 0.24)
Social Avoidance (F4-SA)	0.40 (0.31, 0.49)	0.30 (0.23, 0.37)	0.30 (0.24, 0.38)	0.81 (0.74, 0.86)	---	0.19 (0.14, 0.26)
Social Orienting (F5-SO)	0.50 (0.42, 0.58)	0.30 (0.23, 0.37)	0.20 (0.15, 0.25)	0.82 (0.76, 0.86)	---	0.18 (0.14, 0.24)

All variance components are significant at $p < .05$. No shared environmental influences were found for factors three through five at age 24 months. Like quintavariate models, high heritability (>0.6) was observed for F1 and F2 at both ages and for F3, F4, and F5 at age 24 months only. For all factors, additive

genetic influences showed the largest point estimates versus environmental influences. 95% confidence intervals in parentheses. F=Factor.