Online Appendix

E1. Description of the population-based datasets with references.

The data for this prospective national cohort were obtained by linking information available in the following government-maintained population-based registries: (1) the Medical Birth Registry[1,2] includes data on more than 99% of pregnancies in Sweden since 1973; (2) the Multi-Generation Register[3] contains information about biological and adoptive relationships for more than 11 million individuals living in Sweden since 1933; (3) the Migration Register supplies data on dates for migration into or out of Sweden; (4) the Cause of Death Register contains information on dates and causes of all deaths since 1958; (5) the National Patient Registry[4] provides data on all psychiatric inpatient admissions in Sweden since 1973 and all outpatient diagnoses and care since 2001. Every record has a discharge date, the primary discharge diagnosis, and up to seven secondary diagnoses assigned by the treating medical doctor according to WHO's International Classification of Diseases (ICD-10);[5] (6) the National Crime Register includes detailed information about all criminal convictions in lower court since 1973 on those aged 15 (the age of criminal responsibility) and older;[6] (7) the National School Register[7] includes grades in all subjects for all students at the end of grade nine (at age 16 years) since 1983; (8) the Education Register contains information on highest level of completed formal education between 1988 and 2008; (9) the Conscript Registry includes cognitive, psychiatric, and biometric data for all 18-year-old men in Sweden tested for compulsory military service between 1970 and 2009;[8] (10) the longitudinal integrated database for health insurance and social studies (LISA)[9] contains yearly assessments of income, marital status, unemployment status, social welfare status, and education for all individuals 16 years of age and older since 1990; (11) the Swedish Prescribed Drug Register[10] contains individual-based data for all dispensed pharmaceuticals in the entire population of Sweden since July 2005.

E2. International Classification of Disease (ICD) and Anatomical Therapeutic Chemical Classification (ATC) Codes used to index cases.

Outcome	ICD Version	Data Source	Description	Codes
Psychotic or Bipolar Disorder	8, 9, 10	HDR	Schizophrenia Bipolar disorder Other non-organic psychoses	295, F20 296.1, 296.3, 296A-296E, 296W, F30-F31; 291, 292, 296.0, 296.2, 296.9, 297-299, 296B, 296X, F32.3 x.5 in F10-F19
Autism	9, 10	HDR	Includes disintegrative psychosis, Heller's syndrome, and schizophrenic syndrome of childhood	299, F84
ADHD Diagnosis	9, 10	HDR		314, F90
Suicide Attempt	8, 9, 10	HDR	Both certain and undetermined attempts including violent, non-violent, and other attempts	E950-E959, E980-E989, X60-X84, Y870, Y10-Y34, Y872
Substance Use Problem	8, 9, 10	HDR	Alcohol and drug abuse (excludes nicotine)	303, 304, 305A, 305X, F10 (except x.5), F11-F19 (except x.5)
Criminality	NA	NCR	Any criminal act leading to conviction	Earliest conviction date recorded In the National Crime Register
ADHD Prescription	9, 10	PDR	Excludes Modafinil (ATC-code N06BA09)	N06BA04 (Methylphenidate), N06BA09 (Atomoxetin), N06BA01(Amphetamine), N06BA02 (Dexamphetamine)

Notes: HDR = Hospital Discharge Register; NCR = National Crime Register; PDR = Prescribed Drug Register

Table 1. Baseline characteristics of 3,300,708 offspring born 1973-2008 in Sweden and mortality, psychiatric, academic, and social adversity outcomes by gestational age.

					Gestational Age Group [wk - wk, days (n)]									
Covariates and Outcomes	**Birth Year**	**N**	**Statistic**		**23 - 27, 6 (5,856)**		**28 - 30, 6 (9,663)**		**31 - 33, 6 (23,913)**		**34 - 36, 6 (114,890)**		**37 - 42, 6 (3,146,386)**	
Offspring	1973-2008	3,300,708												
Female			(n, %)		2,661	45.44	4,340	44.91	10,385	43.43	51,741	45.04	1,527,944	48.56
Birth Weight (g)			(M, SD)		928.25	465.59	1,350.79	433.54	1,947.08	480.99	2,703.40	493.53	3,579.47	493.17
Maternal	1924-1995	1,736,735												
Age at birth (yrs)			(M, SD)		28.21	5.94	28.06	5.84	27.83	5.67	27.54	5.42	27.43	5.11
Upper Secondary Education (1-3 yrs)			(n, %)		1,785	50.03	2,931	49.19	7,513	50.29	34,429	49.84	786,682	47.87
Criminality (any)			(n, %)		522	14.63	796	13.36	1,837	12.30	8,519	12.33	179,865	10.95
Paternal	1904-1993	1,729,899												
Age at birth (yrs)			(M, SD)		32.60	6.88	32.08	6.68	31.81	6.61	31.65	6.40	31.73	6.03
Upper Secondary Education (1-3 yrs)			(n, %)		1,512	49.48	2,814	50.99	7,248	50.43	33,861	50.26	804,703	49.08
Criminality (any)			(n, %)		1,162	38.02	2,309	41.84	5,879	40.91	27,086	40.20	610,419	37.23
Mortality														
Infant Mortality	1973-2008	3,300,708	(n, %)		2,352	40.16	1,576	16.31	1,523	6.37	2,167	1.89	8,799	0.28
Died After 1st Year	1973-2008	3,300,708	(n, K-M est)		29	2.16	71	1.73	198	1.65	759	1.36	13,370	0.88
Psychiatric Morbidity														
Psychotic or Bipolar Disorder	1973-1997	2,308,032	(n, K-M est)		34	5.54	83	3.02	183	2.27	811	1.89	18,507	1.53
Autism	1980-2001	2,032,803	(n, K-M est)	‡	84	0.80	103	0.59	205	0.41	754	0.32	14,977	0.29
ADHD Diagnosis	1980-2001	2,032,803	(n, K-M est)	‡	113	1.49	181	1.11	389	0.89	1,417	0.54	28,075	0.35
Suicide Attempt	1973-1997	2,308,032	(n, K-M est)		33	3.59	94	3.38	246	2.70	1,207	2.62	29,328	2.24
Substance Use Problem	1973-1997	2,308,032	(n, K-M est)		34	1.45	144	3.46	368	3.39	1,736	3.32	43,850	3.04
Criminality	1973-1994	2,044,992	(n, K-M est)		136	13.74	596	18.13	1,907	18.53	10,447	19.11	271,543	17.82
Academic Problems														
Failing Grades	1973-1992	1,776,454	(n, %)		285	25.29	832	21.96	2,181	18.82	10,811	17.68	252,469	14.86
Education under 10 yrs	1973-1991	1,689,102	(n, %)		479	44.43	1,316	36.35	3,626	32.58	18,211	31.10	464,578	28.77
Higher Education	1973-1983	911,749	(n, %)		85	19.59	412	23.80	1,464	26.00	8,450	27.95	279,131	31.95
Social Adversity														
Parenthood	1973-1995	2,138,861	(n, K-M est)		176	14.48	802	15.74	2,702	16.01	15,794	16.82	477,438	15.39
Ever Partnered	1973-1990	1,609,646	(n, K-M est)		77	5.31	372	11.99	1,232	16.39	7,402	20.17	197,945	18.92
Social Welfare Benefits	1973-1990	1,609,646	(n, K-M est)		299	37.44	1,021	37.01	3,014	34.15	14,921	31.47	362,204	27.89

Note. n = number of cases in the gestational age group; % = percentage of cases in the gestational age group; M = mean; SD = standard deviation; K-M est = Kaplan-Meier product-limit survival estimate; ‡ = K-M estimate for diagnosis by the age of 10 years; all other estimates are for 25 years of age.

E4. Comparison of the baseline and fixed-effects models with ordinal grouping of gestational age.

The tables below present the unstandardized regression coefficients (with standard errors) and the point estimates (either Odds Ratios or Hazard Ratios, with the 95% confidence intervals) associated with the ordinal bins of gestational age. The estimates for the Baseline Model are equivalent to the point estimates presented in Figure 1.

The estimates for the Fixed-effects models provide sensitivity analyses, which examine the sibling-comparisons results without assumptions about the underlying pattern (i.e., linear or quadratic) of the associations between gestational age and the indices of mortality and morbidity. Figure E4 provides a graphical comparison of the Baseline and Fixed-effects models based on the ordinal analyses. The confidence intervals around the Fixed-effects models using the ordinal bins are larger than those presented in the main analyses, given the loss of statistical power in moving from a continuous representation of gestational age to arbitrary ordinal bins. The Fixed-effects results with the ordinal representation of gestational age, however, give commensurate results with those based on linear and quadratic models presented in the main analyses. The results from these analyses suggest that assumptions about the shape of model fitting using families with multiple offspring (which are the only informative families for the sibling-comparison estimates) do not account for the fixed effects results using the continuous index of gestational age.

Table E.3.1 Maximum likelihood (ML) estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *mortality* outcomes.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Infant Mortality	Baseline	23-27	5.663	0.030	35724.713	<.0001	288.117	271.684	305.544
		28-30	4.288	0.030	20299.455	<.0001	72.832	68.660	77.258
		31-33	3.206	0.029	12371.413	<.0001	24.686	23.330	26.121
		34-36	1.929	0.024	6311.115	<.0001	6.880	6.560	7.215
	Fixed-effects	23-27	5.573	0.186	893.562	<.0001	263.300	182.705	379.449
		28-30	4.094	0.133	947.721	<.0001	59.996	46.229	77.862
		31-33	2.951	0.094	981.611	<.0001	19.117	15.895	22.992
		34-36	1.722	0.055	969.577	<.0001	5.594	5.020	6.235
Died After 1st Year	Baseline	23-27	1.048	0.186	31.783	<.0001	2.852	1.981	4.106
		28-30	0.823	0.119	47.848	<.0001	2.278	1.804	2.876
		31-33	0.736	0.072	105.721	<.0001	2.088	1.815	2.403
		34-36	0.439	0.037	137.846	<.0001	1.550	1.441	1.668
	Fixed-effects	23-27	1.132	0.350	10.490	0.001	3.102	1.564	6.154
		28-30	1.128	0.239	22.352	<.0001	3.089	1.935	4.929
		31-33	0.800	0.136	34.370	<.0001	2.225	1.703	2.908
		34-36	0.480	0.070	47.686	<.0001	1.616	1.410	1.852

Note. The GA (gestational age) reference group included offspring born between 37 weeks and 42 weeks and 6 days. For each group, the table lists the unstandardized regression coefficients (b), the standard error of the estimate (SE), Chi Square statistics, regression coefficients converted to either a hazard ratio (for all right-censored outcomes) or an odds ratio (for logistic outcomes), and 95% confidence limits on the point estimate of the model.

Table E4.2. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *psychiatric morbidity*.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Psychotic or Bipolar Disorder	Baseline	23-27	1.155	0.172	45.331	<.0001	3.173	2.267	4.441
		28-30	0.779	0.110	50.133	<.0001	2.179	1.757	2.704
		31-33	0.407	0.074	29.977	<.0001	1.502	1.298	1.738
		34-36	0.222	0.036	38.364	<.0001	1.249	1.164	1.340
	Fixed-effects	23-27	1.509	0.533	8.027	0.005	4.522	1.592	12.845
		28-30	0.964	0.255	14.276	0.000	2.621	1.590	4.321
		31-33	0.127	0.156	0.670	0.413	1.136	0.837	1.541
		34-36	0.127	0.075	2.901	0.089	1.136	0.981	1.315
Autism	Baseline	23-27	1.176	0.109	115.796	<.0001	3.242	2.616	4.016
		28-30	0.795	0.099	64.631	<.0001	2.214	1.824	2.688
		31-33	0.514	0.070	53.475	<.0001	1.673	1.457	1.920
		34-36	0.230	0.037	37.844	<.0001	1.258	1.170	1.354
	Fixed-effects	23-27	0.932	0.243	14.723	0.000	2.539	1.578	4.087
		28-30	0.944	0.229	17.036	<.0001	2.571	1.642	4.026
		31-33	0.408	0.154	7.002	0.008	1.503	1.111	2.033
		34-36	0.213	0.076	7.962	0.005	1.238	1.067	1.436
ADHD Diagnosis	Baseline	23-27	0.853	0.094	82.343	<.0001	2.347	1.952	2.823
		28-30	0.740	0.075	98.723	<.0001	2.097	1.812	2.427
		31-33	0.533	0.051	109.073	<.0001	1.705	1.542	1.884
		34-36	0.237	0.027	75.772	<.0001	1.268	1.202	1.337
	Fixed-effects	23-27	0.490	0.207	5.619	0.018	1.632	1.089	2.447
		28-30	0.647	0.174	13.911	0.000	1.911	1.360	2.685
		31-33	0.292	0.113	6.712	0.010	1.339	1.074	1.669
		34-36	0.143	0.059	5.916	0.015	1.153	1.028	1.294
Suicide Attempt	Baseline	23-27	0.547	0.174	9.861	0.002	1.728	1.228	2.431
		28-30	0.418	0.103	16.389	<.0001	1.519	1.241	1.860
		31-33	0.253	0.064	15.552	<.0001	1.287	1.135	1.459
		34-36	0.166	0.029	31.859	<.0001	1.180	1.114	1.250
	Fixed-effects	23-27	0.097	0.350	0.077	0.781	1.102	0.555	2.189
		28-30	0.172	0.211	0.670	0.413	1.188	0.786	1.796
		31-33	-0.135	0.123	1.201	0.273	0.874	0.686	1.112
		34-36	0.015	0.056	0.070	0.791	1.015	0.910	1.132
Substance Use Problem	Baseline	23-27	-0.697	0.172	16.516	<.0001	0.498	0.356	0.697
		28-30	0.095	0.083	1.282	0.258	1.099	0.933	1.294
		31-33	0.102	0.052	3.766	0.052	1.107	0.999	1.227
		34-36	0.065	0.024	7.057	0.008	1.067	1.017	1.120
	Fixed-effects	23-27	-0.830	0.259	10.243	0.001	0.436	0.262	0.725
		28-30	-0.284	0.143	3.937	0.047	0.753	0.569	0.997
		31-33	-0.040	0.092	0.191	0.662	0.961	0.802	1.150
		34-36	-0.113	0.043	6.838	0.009	0.893	0.820	0.972
Criminality	Baseline	23-27	-0.340	0.086	15.718	<.0001	0.712	0.602	0.842
		28-30	-0.047	0.041	1.304	0.253	0.954	0.881	1.034
		31-33	-0.025	0.023	1.224	0.269	0.975	0.932	1.020
		34-36	0.026	0.010	6.822	0.009	1.026	1.007	1.047
	Fixed-effects	23-27	-0.413	0.150	7.627	0.006	0.661	0.493	0.887
		28-30	-0.345	0.078	19.591	<.0001	0.708	0.608	0.825
		31-33	-0.196	0.043	20.522	<.0001	0.822	0.755	0.895
		34-36	-0.101	0.019	28.069	<.0001	0.904	0.871	0.938

Note. See note on Table E4.1

Table E4.3. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *academic problems*.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Failing Grades	Baseline	23-27	0.707	0.070	103.517	<.0001	2.028	1.770	2.324
		28-30	0.486	0.040	149.152	<.0001	1.625	1.503	1.757
		31-33	0.267	0.024	122.875	<.0001	1.307	1.246	1.370
		34-36	0.191	0.011	304.984	<.0001	1.210	1.185	1.237
	Fixed-effects	23-27	0.684	0.156	19.184	<.0001	1.982	1.460	2.693
		28-30	0.219	0.086	6.557	0.010	1.245	1.053	1.473
		31-33	-0.015	0.049	0.101	0.751	0.985	0.895	1.083
		34-36	-0.045	0.022	4.119	0.042	0.956	0.915	0.998
Education under 10 yrs	Baseline	23-27	0.544	0.065	69.778	<.0001	1.722	1.516	1.956
		28-30	0.276	0.037	56.661	<.0001	1.318	1.227	1.417
		31-33	0.132	0.022	37.448	<.0001	1.140	1.093	1.190
		34-36	0.072	0.010	56.474	<.0001	1.075	1.055	1.095
	Fixed-effects	23-27	0.305	0.130	5.475	0.019	1.357	1.051	1.752
		28-30	-0.040	0.074	0.296	0.586	0.961	0.831	1.110
		31-33	-0.129	0.043	8.814	0.003	0.879	0.808	0.957
		34-36	-0.154	0.019	63.325	<.0001	0.858	0.826	0.891
Higher Education	Baseline	23-27	-0.672	0.122	30.171	<.0001	0.511	0.402	0.649
		28-30	-0.395	0.057	47.619	<.0001	0.674	0.602	0.754
		31-33	-0.257	0.031	69.214	<.0001	0.773	0.728	0.822
		34-36	-0.159	0.013	144.585	<.0001	0.853	0.831	0.875
	Fixed-effects	23-27	-0.857	0.329	6.768	0.009	0.425	0.223	0.810
		28-30	0.230	0.148	2.413	0.120	1.258	0.942	1.681
		31-33	0.081	0.079	1.050	0.306	1.085	0.929	1.267
		34-36	-0.009	0.033	0.079	0.779	0.991	0.928	1.057

Note. See note on Table E4.1

E4.4. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *social adversity*. The GA reference bin included offspring born between 37 weeks and 42 weeks and 6 days.

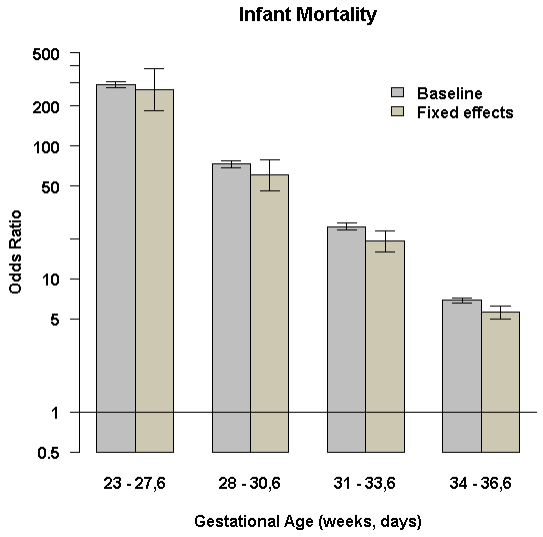
Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Parenthood	Baseline	23-27	-0.303	0.075	16.121	<.0001	0.739	0.637	0.857
		28-30	-0.075	0.035	4.507	0.034	0.928	0.866	0.994
		31-33	-0.070	0.019	13.113	0.000	0.933	0.898	0.968
		34-36	0.021	0.008	6.638	0.010	1.021	1.005	1.037
	Fixed-effects	23-27	-0.539	1.238	0.190	0.663	0.583	0.052	6.597
		28-30	0.150	0.447	0.113	0.737	1.162	0.484	2.792
		31-33	-0.071	0.235	0.091	0.763	0.931	0.587	1.478
		34-36	0.331	0.104	10.164	0.001	1.392	1.136	1.706
Ever Partnered	Baseline	23-27	-1.422	0.113	158.092	<.0001	0.241	0.193	0.301
		28-30	-0.490	0.052	89.117	<.0001	0.613	0.553	0.678
		31-33	-0.144	0.029	25.409	<.0001	0.866	0.819	0.916
		34-36	0.102	0.012	74.604	<.0001	1.108	1.082	1.134
	Fixed-effects	23-27	-1.957	0.219	79.797	<.0001	0.141	0.092	0.217
		28-30	-0.756	0.108	48.876	<.0001	0.469	0.380	0.580
		31-33	-0.274	0.065	17.884	<.0001	0.761	0.670	0.864
		34-36	-0.010	0.028	0.136	0.712	0.990	0.936	1.046
Social Welfare Benefits	Baseline	23-27	0.295	0.058	25.909	<.0001	1.342	1.199	1.504
		28-30	0.318	0.031	103.167	<.0001	1.375	1.293	1.462
		31-33	0.242	0.018	174.896	<.0001	1.274	1.229	1.320
		34-36	0.157	0.008	353.324	<.0001	1.170	1.151	1.189
	Fixed-effects	23-27	0.208	0.121	2.931	0.087	1.231	0.970	1.562
		28-30	-0.019	0.065	0.082	0.774	0.981	0.864	1.115
		31-33	-0.065	0.038	2.960	0.085	0.937	0.871	1.009
		34-36	-0.011	0.017	0.411	0.521	0.989	0.957	1.023

Note. See note on Table E4.1

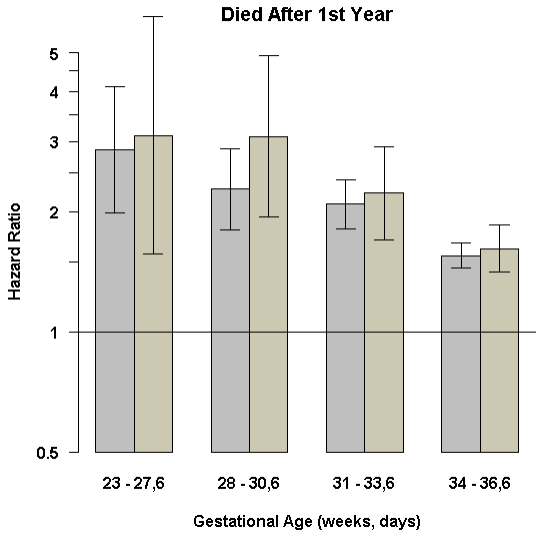
E4. Figures. Comparison of the baseline and fixed-effects models with ordinal grouping of gestational age.

Mortality

E4.1

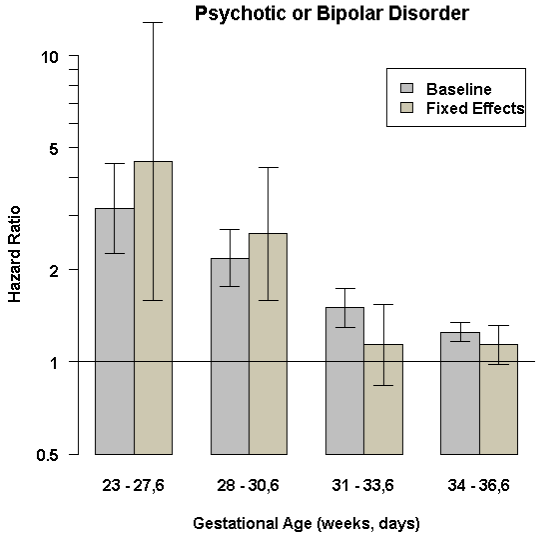


E4.2



Psychiatric Morbidity

E4.3



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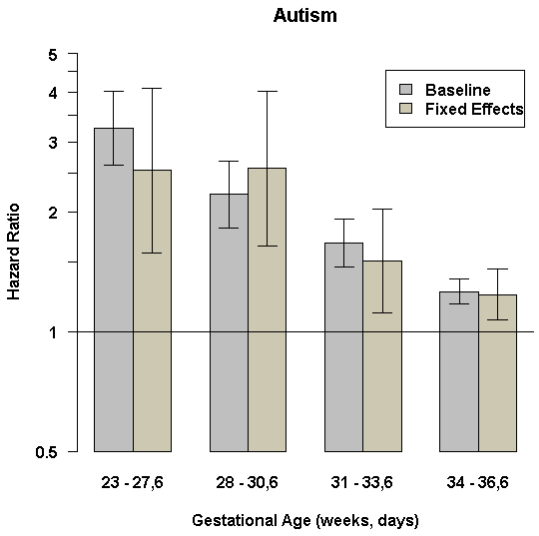
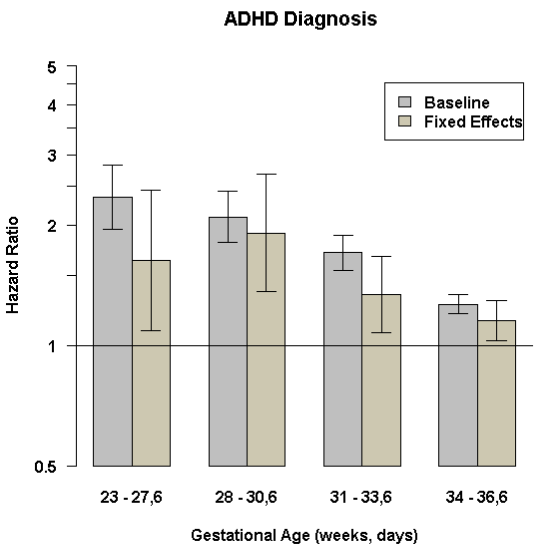
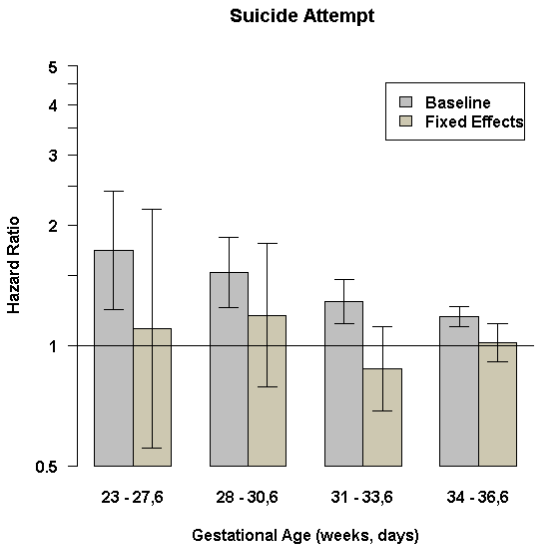


Psychiatric Morbidity (continued)

E4.5



E4.6



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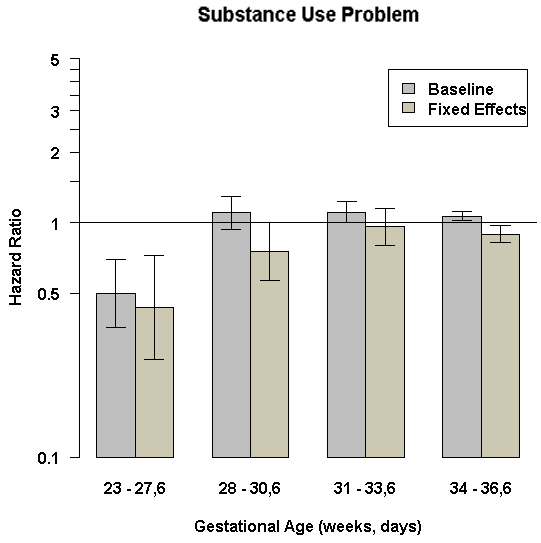

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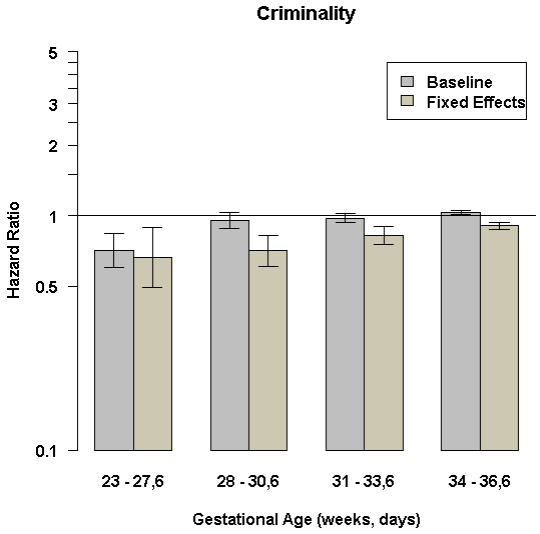
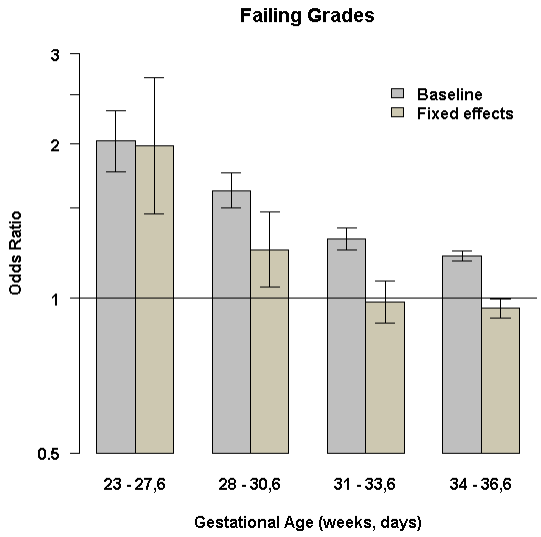
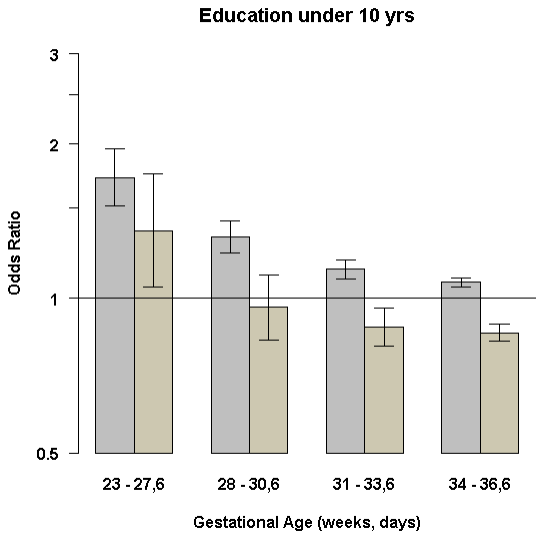


Academic Problems

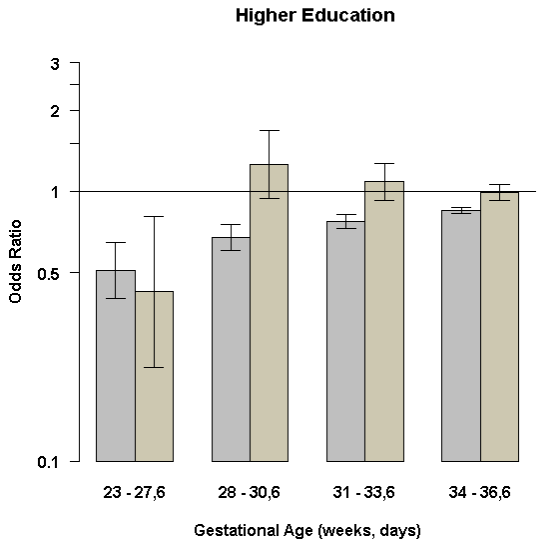
E4.9



E4.10

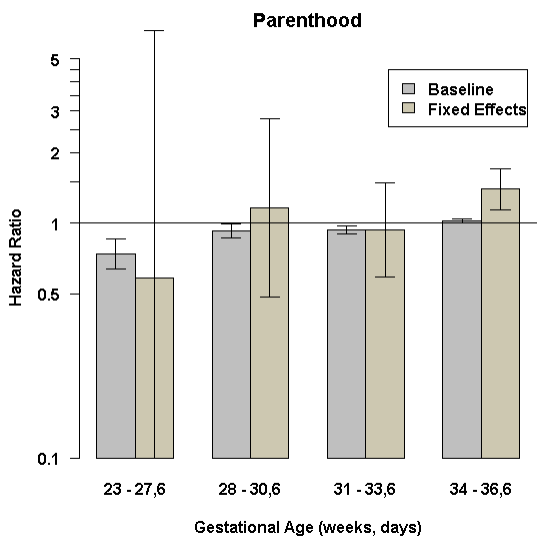


E4.11

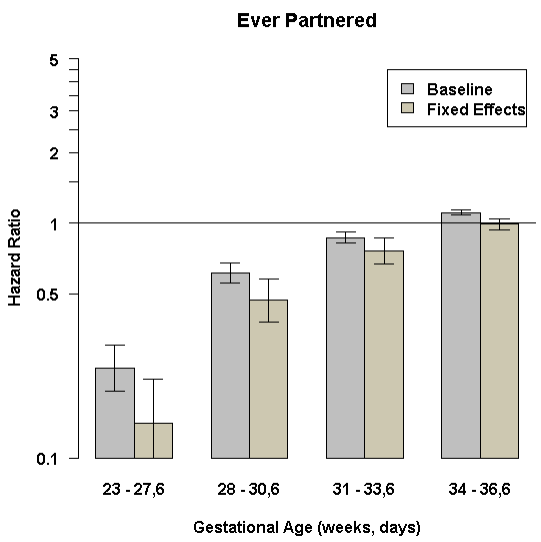


Social Adversity

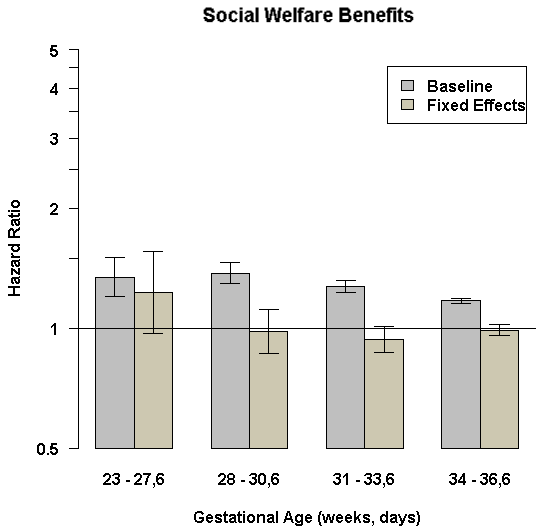
E4.12



E4.13



E4.14



Note. The online appendix figure set presents the comparison of the estimates from the baseline model (that did not control for selection factors) in gray and the fixed-effects models (that controlled for all factors that make siblings similar and the measured covariates) in beige associated with each ordinal category of gestational age for mortality, psychiatric morbidity, cognitive problems, and social adversity compared to offspring born at term. The point estimate for the reference category (i.e., 37 weeks - 42 weeks and 6 days) is equal to 1 (not shown). Error bars represent the 95% Wald confidence limits on the hazard/odds ratio parameter.

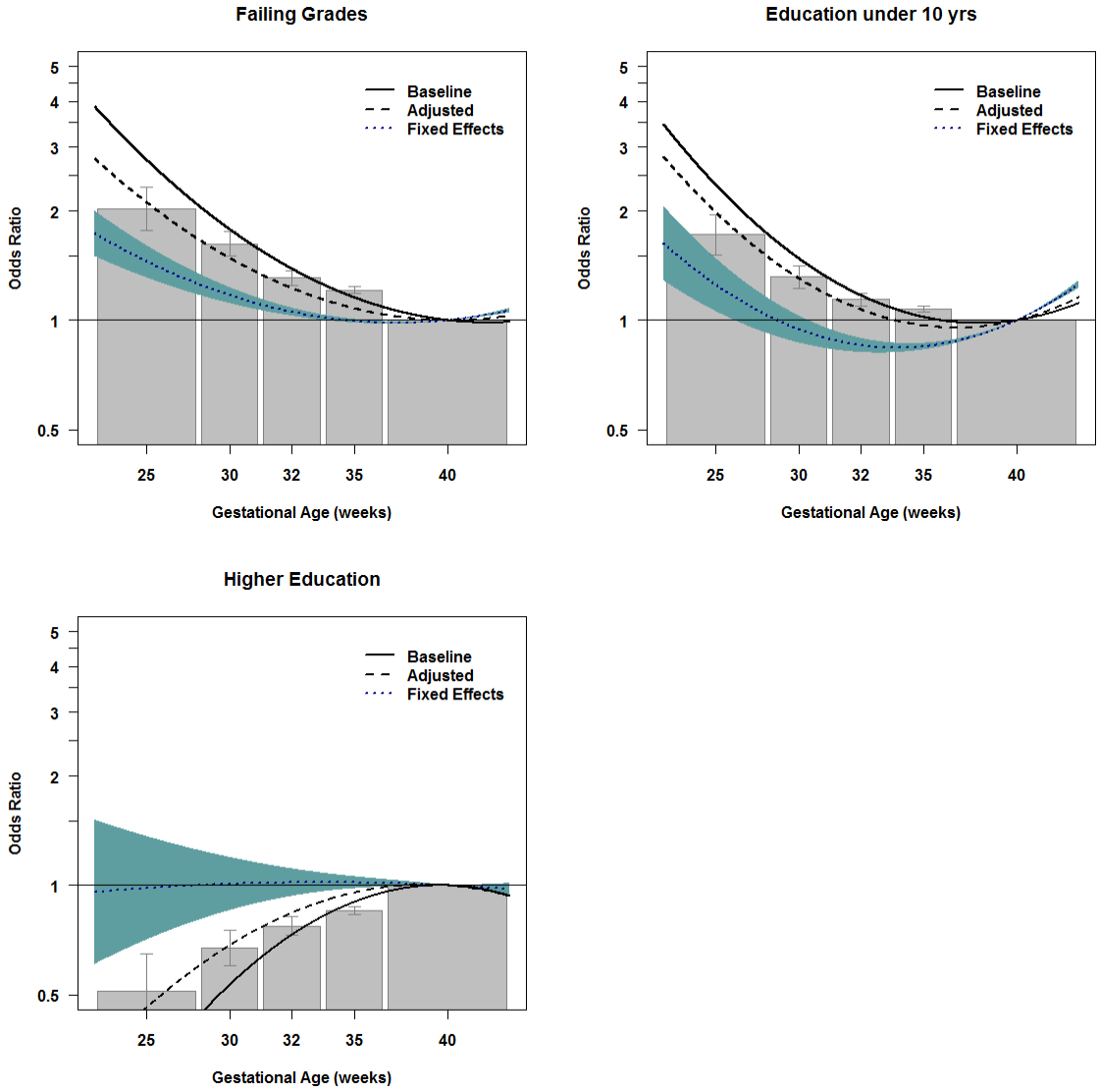
E5. Model selection table comparing the Fit Indices for the linear and quadratic baseline models.

		Model			
	Outcome	**Linear GA only**	**add Quadratic GA**	**AIC-min choice**	**ΔAIC**
Mortality					
	Infant Mortality	165416	165336	L + Q	80.70
	Died After 1st Year	409949	409932	L + Q	17.62
Psychiatric Morbidity					
	Psychotic or Bipolar Disorder	539265	539266	L	-1.43
	Autism	452303	452264	L + Q	39.49
	ADHD Patient	844589	844583	L + Q	6.15
	Suicide Attempt	863696	863698	L	-1.78
	Substance Use Problem	1304150	1304097	L + Q	52.60
	Criminality	7996315	7996317	L	-1.80
Academic Problems					
	Failing Grades	1472772	1472572	L + Q	200.00
	Education under 10 yrs	1846958	1846446	L + Q	511.50
	Higher Education	1112100	1111804	L + Q	296.10
Social Adversity					
	Parenthood	12461676	12461267	L + Q	409.00
	Ever Partnered	5461498	5453188	L + Q	8310.10
	Social Welfare Benefits	10657582	10657205	L + Q	377.00

Note. The model selection table compares the AICs for the baseline model with linear (L) gestational age only and the baseline model with both linear and quadratic (L+Q) gestational age. The column labeled "AIC-min choice" indicates which of the two candidate models (L or L+Q) yielded the lowest AIC. The observed difference, $\Delta AIC = AIC_L - AIC_{L+Q}$, provides a measure of relative merit that is free of scaling constants and can be interpreted as strength of evidence for model selection purposes.[11] For example, consider the three outcomes (psychotic or bipolar disorder, suicide attempt, and criminality) for which the model with linear GA only yielded a lower AIC than the model with both linear and quadratic GA. In each case, the rescaled difference $|\Delta AIC| < 2$ (small) indicates substantial support for the quadratic model even though the linear model yielded a lower AIC. By contrast, outcomes with $|\Delta AIC| > 10$ indicate that the linear model has virtually no support relative to the quadratic model. For all outcomes, the model selected using AIC-min as the criterion is the one selected using the significance level (p-value) of the quadratic coefficient as the criterion.

E6. Modeling results for Academic Problems and additional indices of offspring outcomes (e.g., prescriptions for ADHD, Low IQ, Low Income, and High Income).

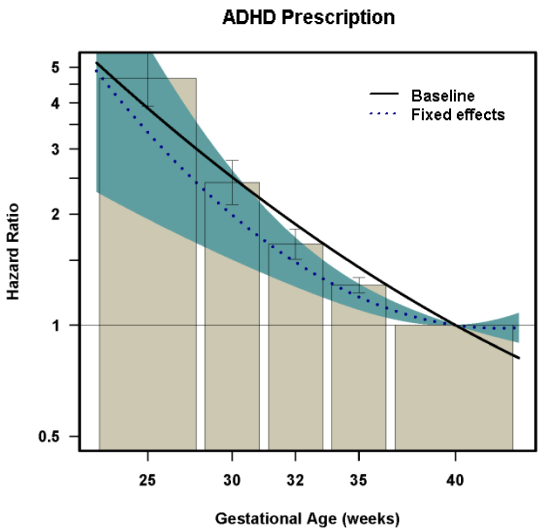
Academic Problems



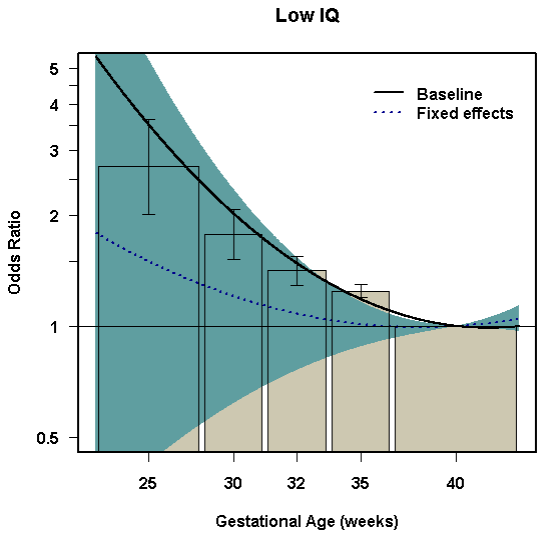
Note. See note in main text for detailed information regarding the interpretation of the figures.

ADHD is based on the prescription registry (see description in E1 and E2). Low IQ (males only) was indexed using a composite measure of general intellectual performance available in the conscript register (see E1) for years 1988-2007. The measure assesses logical-inductive reasoning, verbal ability, visual-spatial perception, as well as theoretical-technical skills. We created a dichotomous outcome by grouping male conscripts in the lowest two stanine scores (1 or 2) into a single category representing low intellectual performance, consistent with previous research.[13] Low income was based on age of individuals the first time their total family income fell below the 20th percentile of total family-level disposable income estimated separately for years 1990-2008 using information in LISA. High income is based on the same approach for identifying individuals with low income, although we identified individuals who were ever in the top 20th percentile.

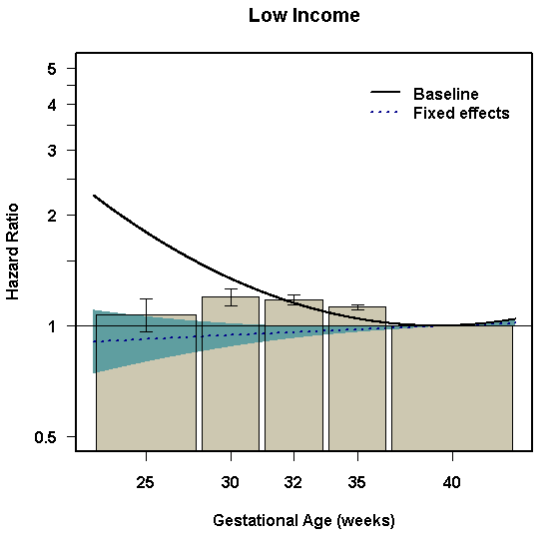
E6.1



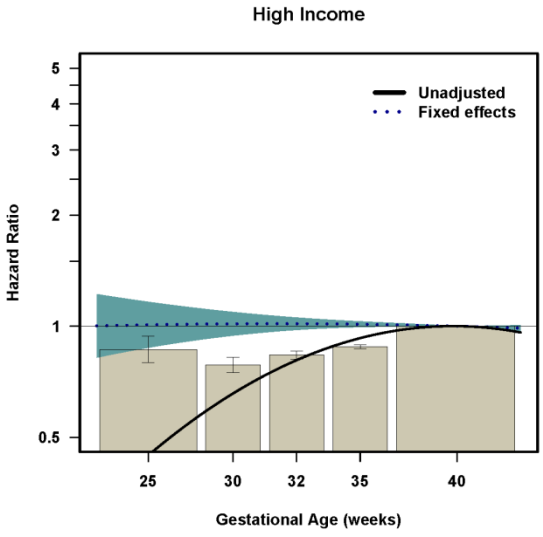
E6.2



E6.3



E6.4



Note. See note in main text for detailed information regarding the interpretation of the figures.

E7.Figures. Comparison of the baseline model association gestational age and offspring outcomes estimated separately for (a) offspring from families with more than one child and (b) for offspring without siblings.

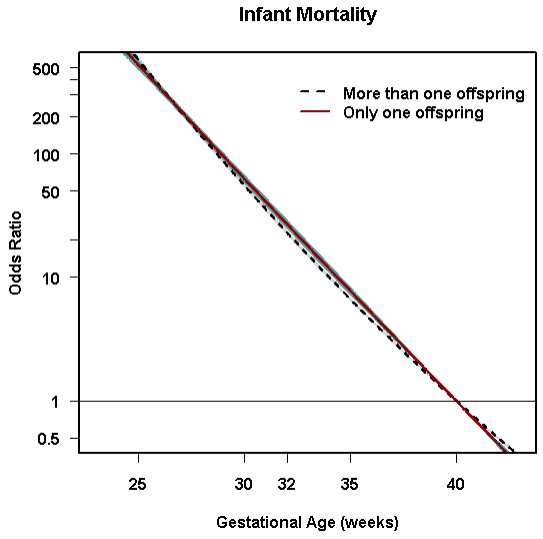
Sibling-comparison studies make assumptions about the generalizability of findings from families with multiple offspring to families with only one child. For instance, these designs assume that the magnitude of the associations is comparable in the two types of families. The interpretation of the sibling-comparison results could be confounded if the population-based associations were lower in offspring who had siblings. To help assess whether the assumptions were warranted or justified we estimated the population-based estimates between gestational age and offspring outcomes in (a) offspring with siblings and (b) offspring without siblings.

Each figure below presents two baseline models. One model (dashed blue line with 95% confidence region shaded light grey) was estimated on the sub-sample of offspring (n=2,665,666, 80.8% of the entire sample) from families with more than one child. The mean gestational age in the subsample was 278.9 days (SD=12.39). The second model (solid red line with 95% confidence region shaded blue) was estimated on the sub-sample of offspring without siblings (n=635,042, 19.2% of the total sample). The mean gestational age in the subsample was to 278.7 days (SD=13.08).

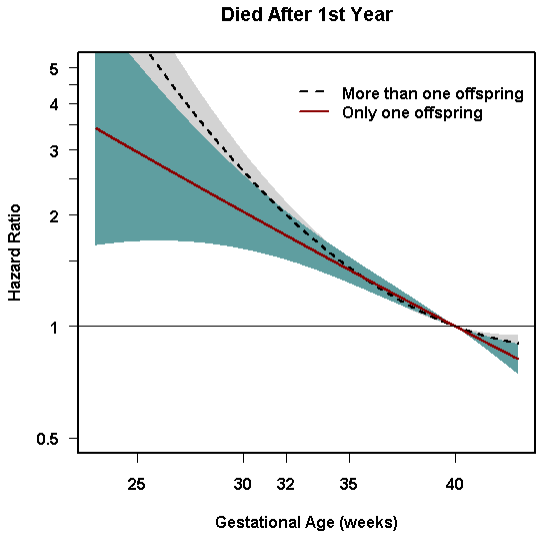
The figures (a) show that the baseline associations are largely comparable for the two sets of offspring and (b) suggest that the differences between these two subsamples do not account for any smaller sibling-comparison estimates. First, for each outcome, the associations in the two subsamples were always in the same direction. Second, the magnitude of the associations greatly overlap. This is particularly true when considering that 99.5% of the entire sample (n=3,284,582) had a gestational age of 31 weeks or longer. Third, where the magnitudes of the associations do not overlap, which generally occurred in the lowest gestational age range, the associations with GA are actually stronger for the offspring with siblings. The sensitivity analyses show that the sibling-comparison results that showed a reduction (e.g., with grades and educational attainment) or complete attenuation of the associations (e.g. suicide, low income, and receiving social benefits) are *not* due to a lower population-based estimate in offspring with siblings than in offspring without siblings. The one exception to this pattern of findings is for criminality, but the sibling-comparison results in the main analyses showed a robust, independent association.

Mortality

E7.1

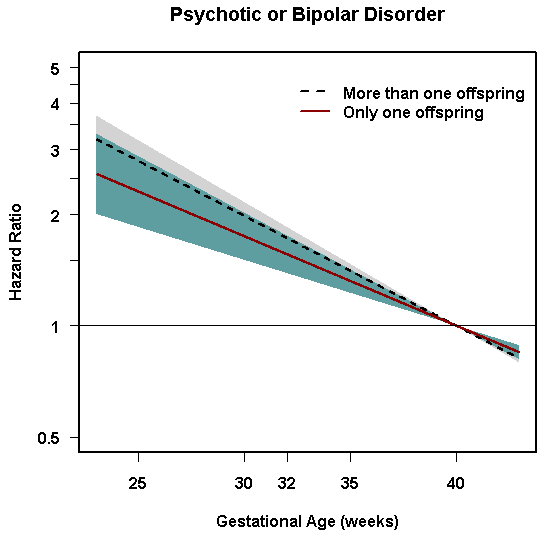


E7.2

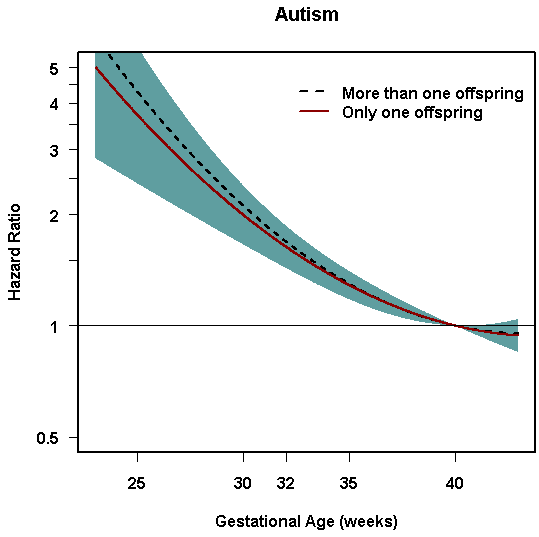


Psychiatric Morbidity

E7.3

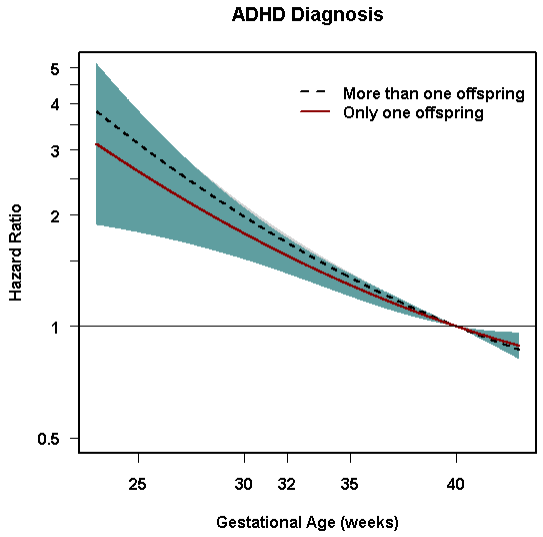


E7.4

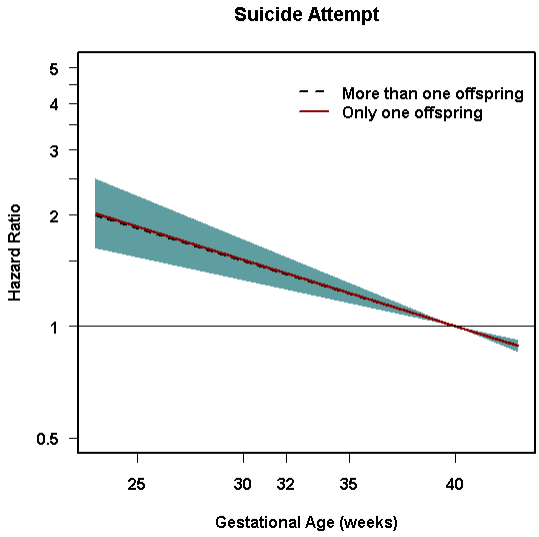


Psychiatric Morbidity (continued)

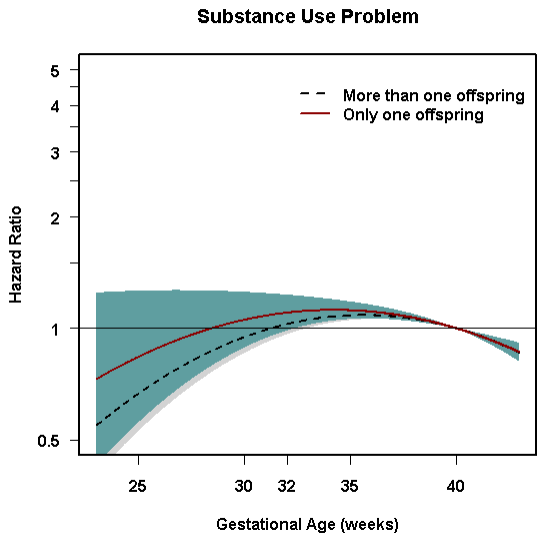
5.5



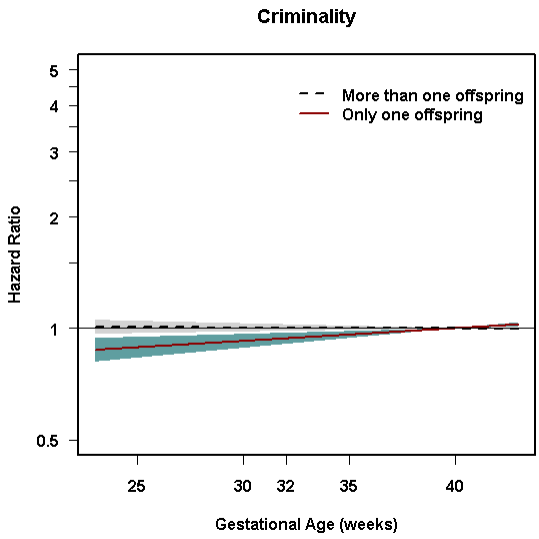
E7.6



E7.7

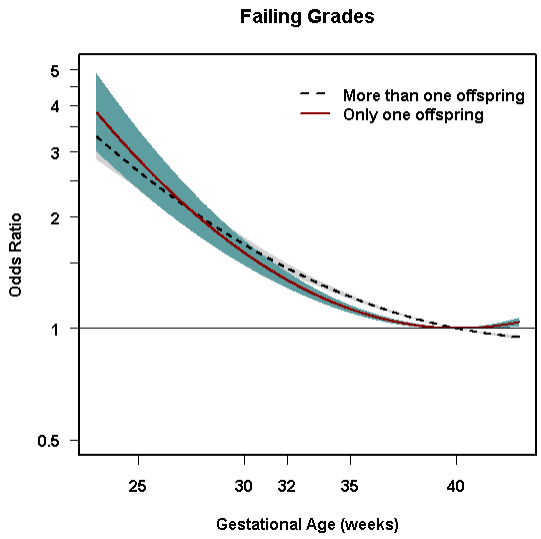

Substance Use Problem
More than one offspring
Only one offspring
Hazard Ratio
5
4
3
2
1
0.5
25
30
32
35
40
Gestational Age (weeks)

E7.8

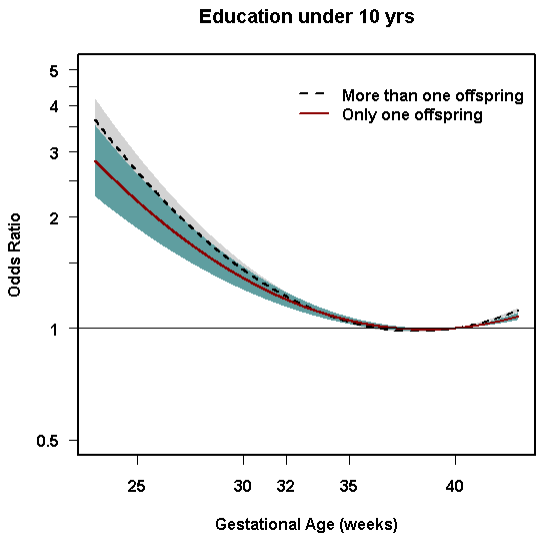

Criminality
More than one offspring
Only one offspring
Hazard Ratio
5
4
3
2
1
0.5
25
30
32
35
40
Gestational Age (weeks)

Academic Problems

E7.9



E7.10



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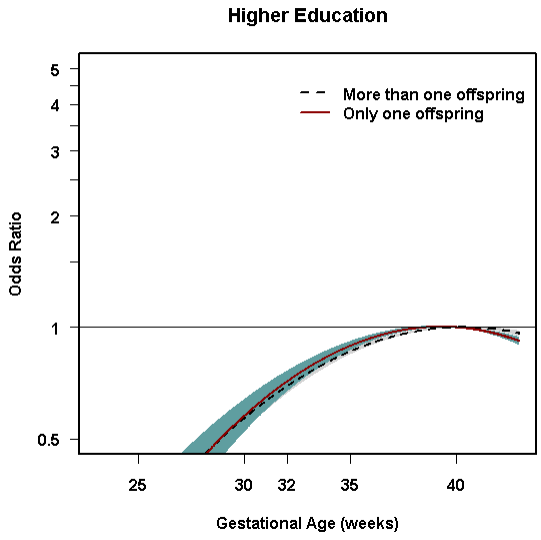
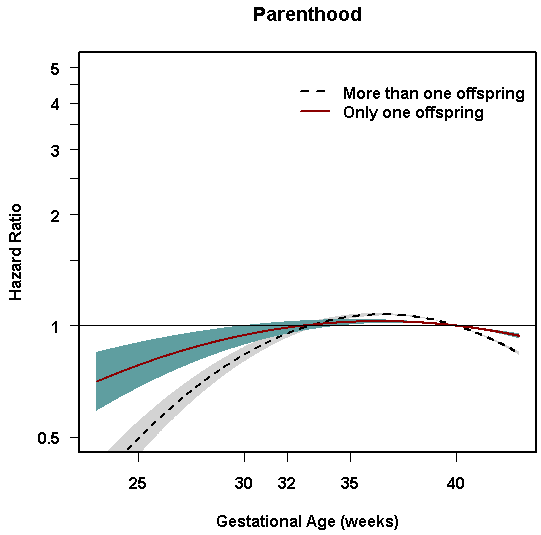
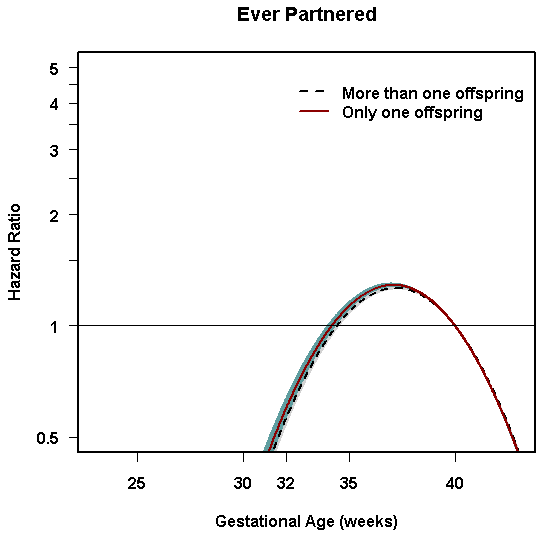


Social Adversity

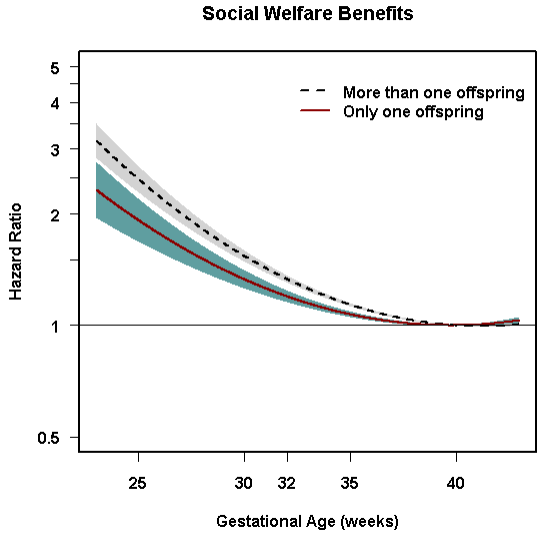
E7.12



E7.13



E7.14



E8. Results of cousin-comparison analyses of gestational age and offspring outcomes.

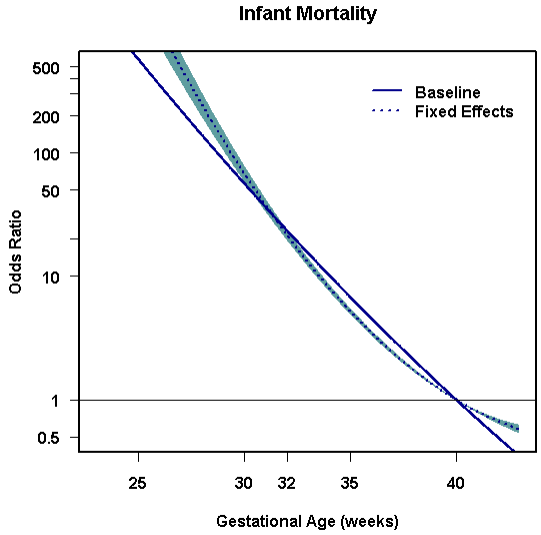
The cohort in the main analysis consisted of N=3,300,708 individuals born to 1,736,735 unique mothers and 1,729,899 unique fathers. For the cousin comparison analysis, we used the Multigenerational Register to identify the maternal grandmothers of all offspring in the original cohort. Data for 331,972 individuals were excluded from this sensitivity analysis due to missing identifiers for the grandmothers. Thus, the final cohort for the cousin-comparisons consisted of N=2,968,736 offspring born to 1,542,984 unique mothers and 1,553,140 unique fathers with cousins clustered by 1,162,228 unique maternal grandmothers.

We fit two models for each outcome, the baseline and the fixed-effects models. It is important to note that the fixed-effects models in these analyses compared differentially exposed cousins (rather than siblings). The results are presented in Figure E8, where we plotted the baseline risk with the solid blue line. The cousin-comparison results are presented with the dotted blue lines, with the 95% confidence intervals represented by the shaded blue. Overall, the results of the cousin-comparison models are commensurate with the results from the sibling-comparison models. First, the association between GA and many of the outcomes remained robust when comparing differentially exposed cousins. Second and most important, though, the associations between GA and suicide attempts, school grades, educational attainment, and receiving social welfare benefits were all greatly attenuated in the cousin-comparison models, which are consistent with the siblings-comparison results. Carryover effects are arguably less of a concern when comparing cousins than when comparing siblings. Because the associations between GA and these outcomes were attenuated both in sibling- and cousin-comparisons the results strongly suggest that carry-over effects do not account for the attenuated associations with GA.

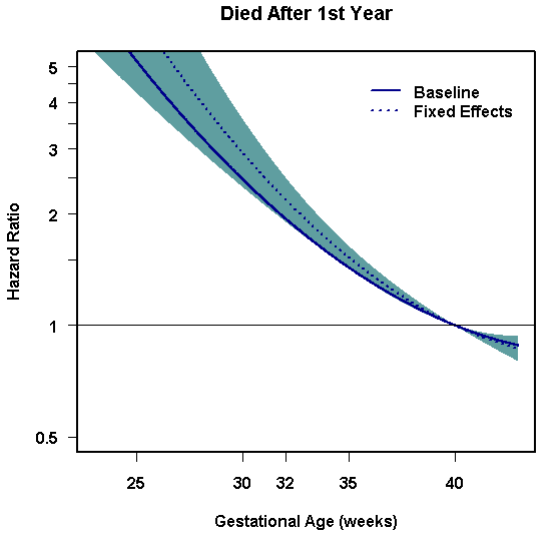
E8. Figures. Comparison of the baseline and fixed-effects models for the association between continuous gestational age and offspring Mortality, Psychiatric Morbidity, Academic Problems, and Social Adversity.

Mortality

E8.1

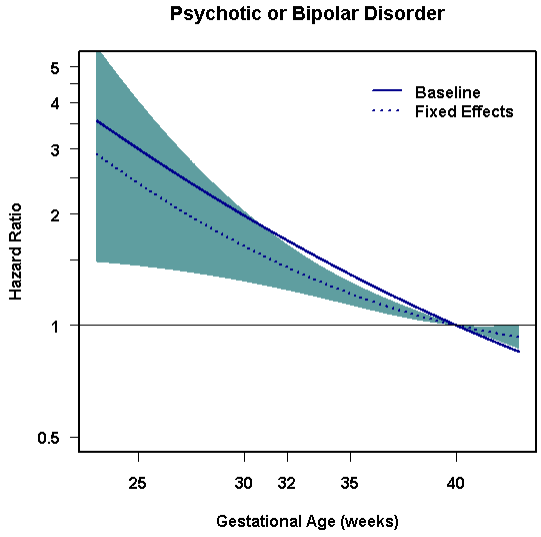


E8.2

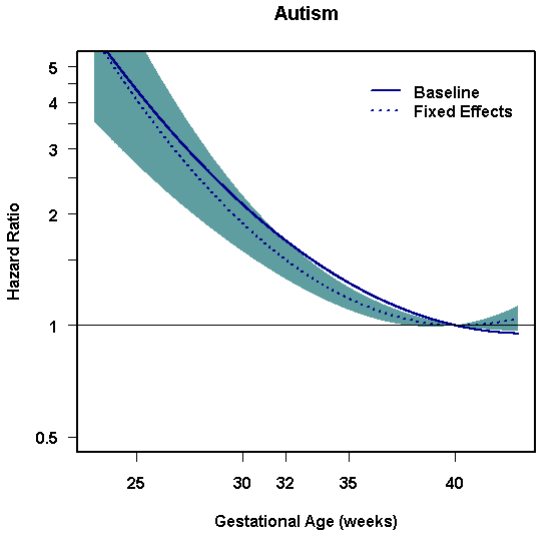


Psychiatric Morbidity

E8.3

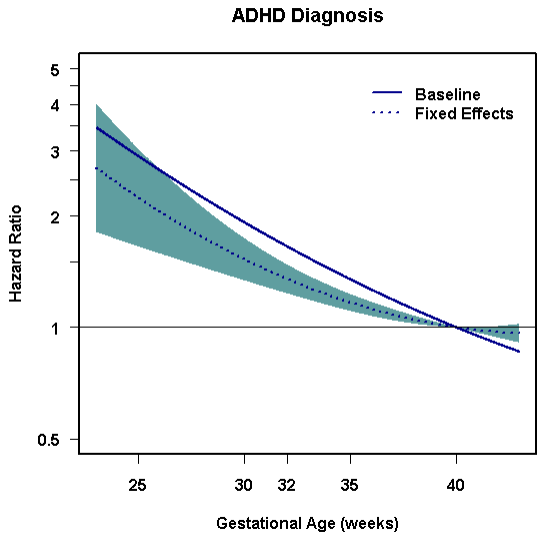


E8.4

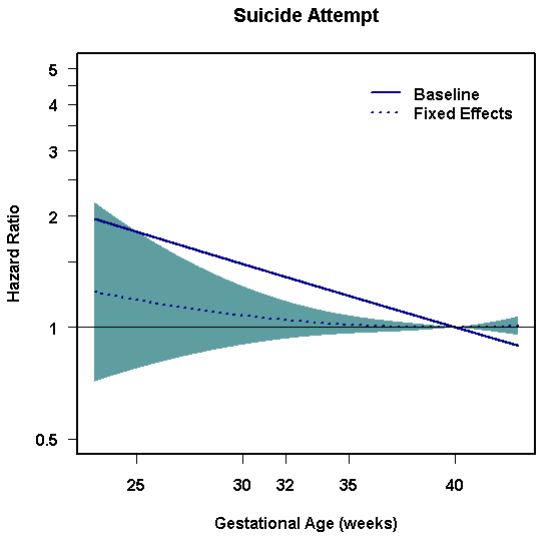


Psychiatric Morbidity (con't)

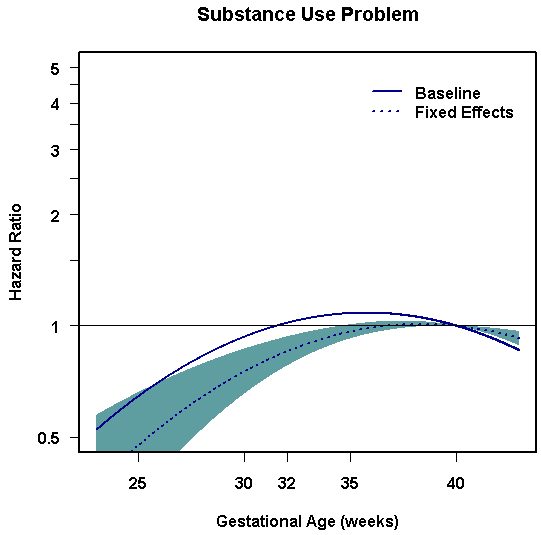
E8.5



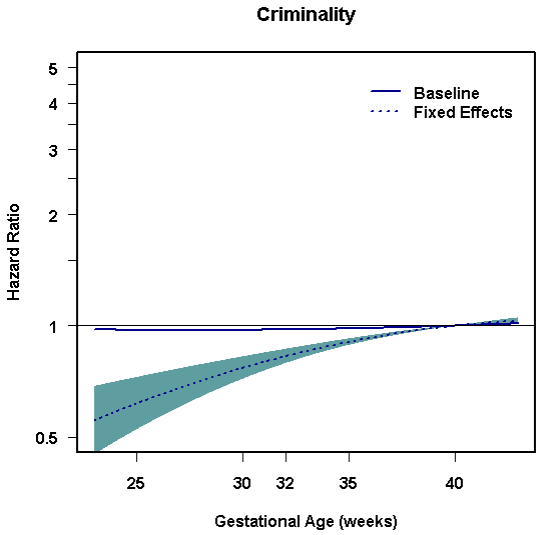
E8.6



E8.7

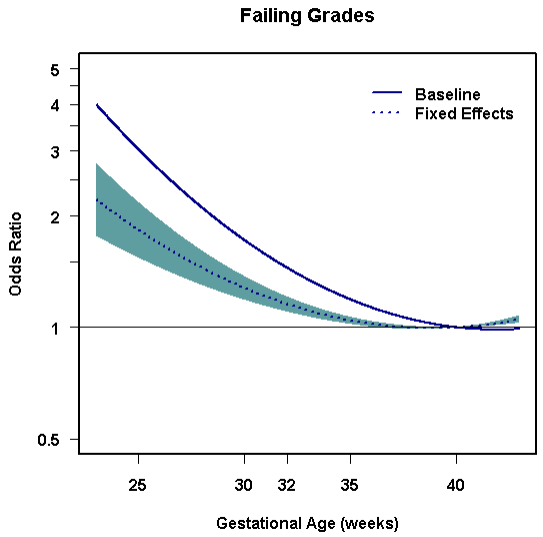


E8.8

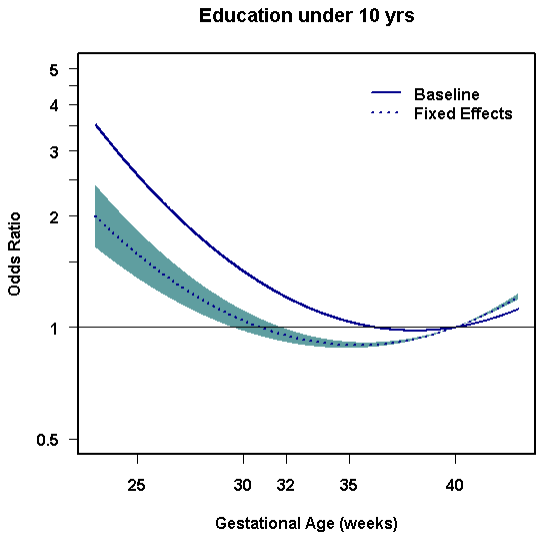


Academic Problems

E8.9



E8.10



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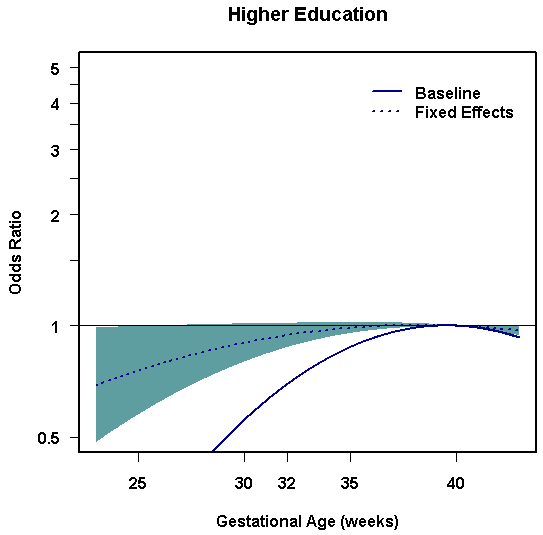
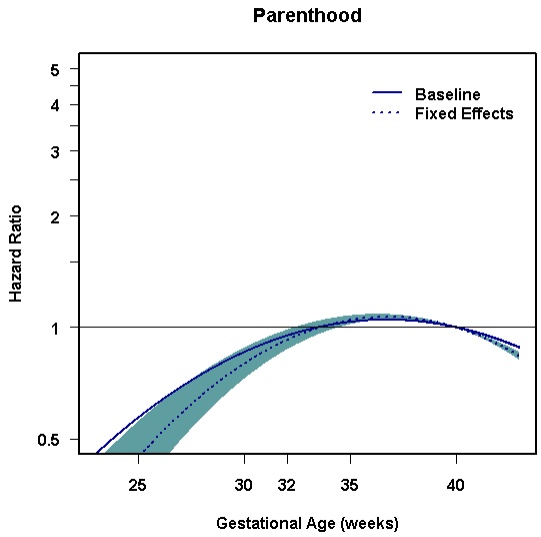
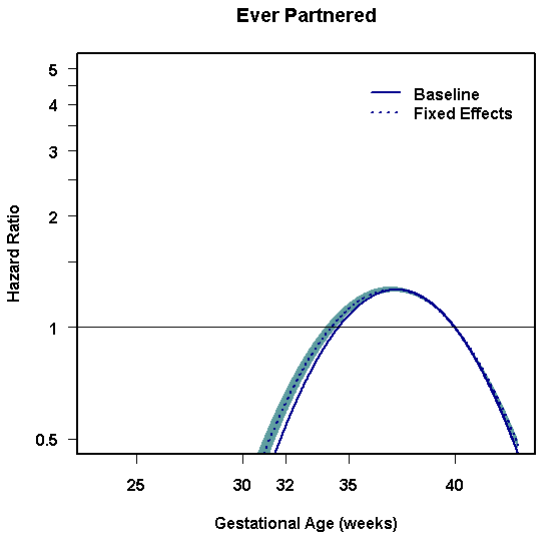


Social Adversity

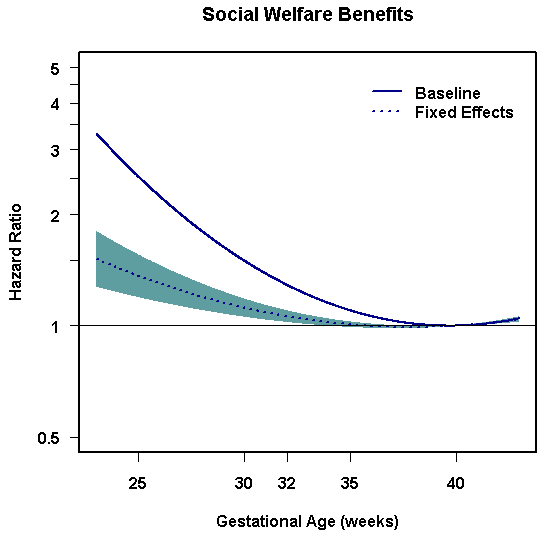
E8.12



E8.13



E8.14



E9. Bidirectional case-crossover analyses results.

Sibling-comparison designs, similar to most research approaches, assume that the exposure to a risk of one individual does not influence the outcome of another individual. In this particular study, the use of the design assumes that exposure to early GA of an individual does not influence the outcome for his/her siblings (i.e., carry-over effects). To help account for the influence of birth order in the main analyses we included the covariate in all analyses. To more specifically address the assumption of carryover effects, however, we conducted bidirectional case-crossover analyses, which explored whether different patterns of early gestational age within families (i.e., either the first- or second-born offspring had early gestational age) moderated the sibling-comparison results.[12] The results would suggest a carry-over effect if there was a smaller sibling-comparison estimate in families where the first sibling had an earlier GA than in families where the second sibling had an earlier gestational age. In families where the first-born offspring had an earlier gestational age, all subsequent children would be exposed to the risk factor throughout their lifetime—because all siblings would be exposed the comparison of the siblings would not yield a difference if there was a carryover effect. In contrast, in families where the second-born offspring had an earlier gestational age, the first-born offspring would not be exposed throughout their entire lifetime. We conducted sibling-comparison models in the first- and second-offspring of all of the families to examine the possibility of carryover effects using the same analytical approach as described in D'Onofrio et al.[13]

The initial cohort included data for N=3,300,708 offspring born in Sweden between 1973 and 2008 to 1,736,735 unique mothers. For the bi-directional case-crossover analysis we identified and retained data for 1,979,180 offspring who were all of the first- and second-born siblings from 989,590 sibling pairs. We then created a binary indicator variable that identified families in which the first-born sibling had an earlier gestational age than the second-born sibling (variable=1, n=457,615 pairs, 46.2% of the subsample). The remaining families, those where the second-born sibling had an earlier gestational age than the first-born sibling, were given a value=0.

We estimated two fixed-effects models in the analyses of each outcome variable. Both of the models for these sensitivity analyses used the continuous representation of gestational age (zero-centered re: week 40 and scaled in weeks). In the first model, each outcome was predicted by linear and quadratic gestational age (GA), plus all offspring-specific covariates. This model is identical to the fixed-effects model for the main analyses but is estimated on the reduced sample of first- and second-born siblings only. It is important to note the first model, which estimated two variables associated with GA (the linear and quadratic parameters), constrained the sibling-comparison parameters to be equal for all families, regardless of whether the first- or second-born siblings had an earlier gestational age. The second model included the same set of predictors plus two additional parameters representing (1) the interaction of linear GA with the binary variable (described above) that indicated whether the first- or second-born sibling had a shorter GA and (2) the interaction of quadratic GA with the binary variable described above. The second model, which estimated four variables associated with GA, provides a model parameterization equal to estimating separate linear and quadratic models for the two groups of families (one model for families in which the first-born had an earlier gestational age and one model for families in which the second-born had an earlier gestational age). We then compared the fit indices of the two models. The model fit comparisons provided a direct comparison of a model that specified the same association with GA across all families with a model that allowed the association with GA to differ in the two groups of siblings. Finally, we plotted the sibling-comparison results separately for the two groups to examine the pattern of the findings and further explore the possibility of carry-over effects.

Table E9 presents the model fit statistics (Akaike's Information Criterion; AIC) for the two models. The differenced ΔAIC in the final column equals the AIC for the model that includes the interaction minus AIC for the model without the interaction. The results suggest that adding the interaction terms (and thus fitting a separate model in each type of family) did not fit the data better for most of the outcome variables (where ΔAIC is > -2). The models could not be fit to the parenthood data because of the small sample sizes when separating the fixed effects models into separate groups based on the timing of the early GA. There are two outcome variables where the model fitting suggested two separate associations fit the data better—infant mortality and failing grades. The model comparisons for psychotic and bipolar disorder were also marginal.

To get a better sense of the results we present a number of panels in Figure E9. For each outcome variable the left panel presents the basic baseline model and the fixed-effects results for the subsample that only included the first- and second-born offspring. The fixed-effects results in the left panel present the model fitting where the sibling-comparisons were held constant for all of the families. It is important to note that the sibling-comparison results are consistent with those run on the entire sample in the main text, which included all offspring. In panel B, the figure presents the fixed-effects results separately for (a) families in which the first-born child had an earlier GA and (b) families in which the second-born child had an earlier GA.

When predicting infant mortality, the bidirectional case-crossover analyses suggest that the association was actually larger in families where the first-born offspring had the earlier GA, which is contrary to the presence of a carryover effect. It is important to note, however, that early GA was strongly associated with infant mortality in both types of families, supporting the substantive conclusion from the main analyses. When predicting low education, the sibling-comparison estimates were lower in families where the first-born offspring had the earlier GA than in families where the second-born offspring had the earlier GA. This is the pattern of findings that would be predicted for a carryover effect. When predicting psychotic and bipolar disorder, the pattern of results provided marginal support for fitting separate associations in the two groups. When exploring the pattern of the results in panel B, the association between earlier GA and psychotic and bipolar disorder were actually somewhat larger in families where the first-born had the earlier GA—this pattern is contrary to what would be predicted from a carryover effect. Shorter GA was associated with psychotic and bipolar disorder in both groups, however, supporting the findings from the main analyses.

Bidirectional, case-crossover analyses do not rule out the possibility of carryover effects, but the results of the analyses are not consistent with carryover effects for most of the outcome variables. The lone exception is low educational attainment. Because we are making so many model comparisons (and running multiple models), the lower sibling-comparison estimate in families where the first-born sibling had an earlier gestational age for this one outcome could be a statistical artifact of the multiple testing in this project. Future research, including more sibling-comparison studies and quasi-experimental research using other designs, will need to further explore the associations between gestational age and offspring mortality and morbidity, especially with low educational attainment.

Table E9. Model AIC fit indices.

		Model		
	Outcome	**without interaction**	**with interaction**	**ΔAIC**
Mortality	Infant Mortality	6,769.7	6,761.3	-8.4
	Died After 1st Year	8,744.8	8,747.8	3.1
Psychiatric Morbidity	Psychotic or Bipolar Disorder	8,877.2	8,875.4	-1.9
	Autism	8,451.1	8,453.2	2.1
	ADHD Diagnosis	13,469.6	13,473.1	3.5
	Suicide Attempt	16,031.4	16,033.6	2.2
	Substance Use Problem	27,190.4	27,192.3	1.9
	Criminality	147,246.1	147,248.6	2.5
Academic Problems	Failing Grades	97,121.5	97,125.1	3.6
	Education under 10 yrs	150,368.4	150,342.5	-25.9
	Higher Education	73,242.5	73,501.2	258.7
Social Adversity	Parenthood	*--- parameter estimates were numerically unstable or NAN ---*		
	Ever Partnered	73.910.5	41698.7	-32,211.9
	Social Welfare Benefits	145,422.1	145,422.3	0.2

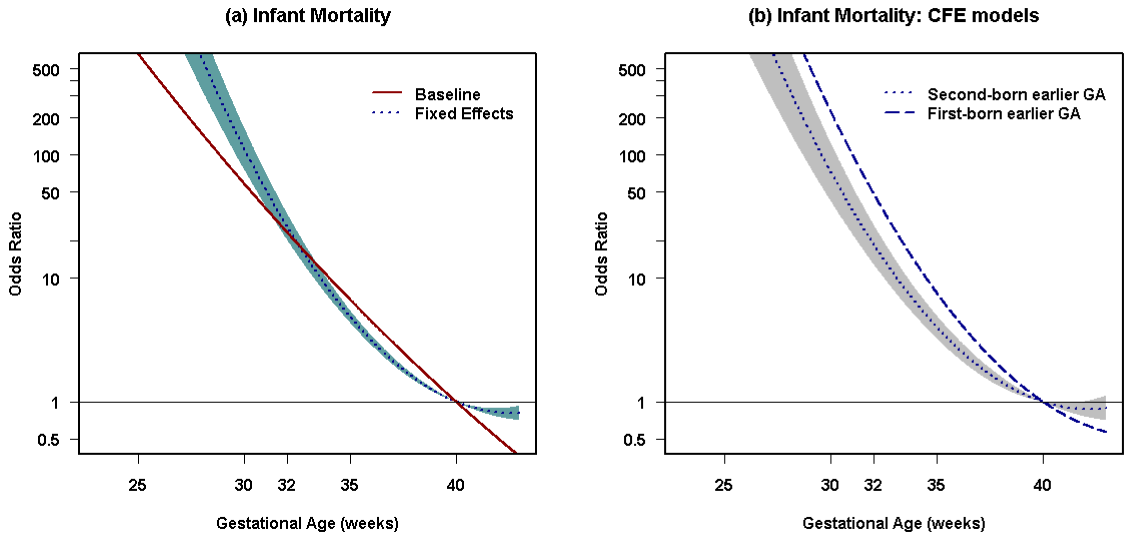
Note. The model selection table compares the AICs for the model without interactions (constraining the parameters associated with gestational age to be the same regardless of the order of lower gestational age within siblings pairs) with the model with interactions (which estimated separate associations between gestational age and the outcome for families where the first-born and second-born siblings had early gestational age). The column labeled "AIC-min choice" indicates which of the two candidate models yielded the lowest AIC. The observed difference, $\Delta AIC = AIC_{Interactions} - AIC_{No\ int}$, provides a measure of relative merit that is free of scaling constants and can be interpreted as strength of evidence for model selection purposes.[11] For most variables the rescaled difference $|\Delta AIC| > -2$ (small) indicates substantial support for equivalent sibling-comparison parameters in both groups. By contrast, outcomes with $|\Delta AIC| < -2$ indicate that the models with the interactions (fitting separate associations in the two groups of families) was a better fit to the data. To better interpret the results, Figure E9 presents the associations for the different models.

E9.Figures. Bidirectional case-crossover analyses figures.

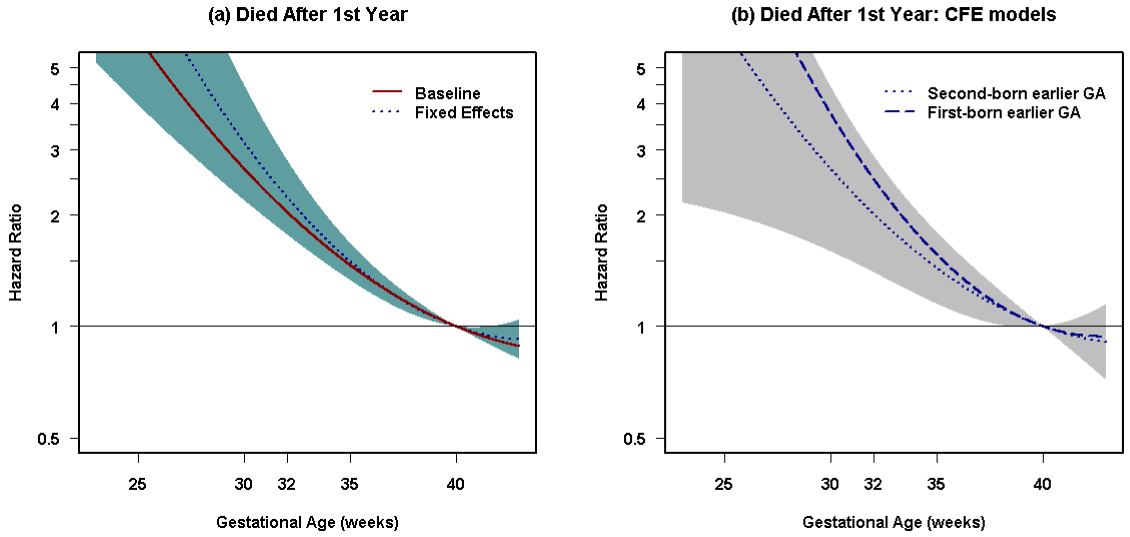
Figures in the left-hand column (a) compare the population-based estimate of the association between gestational age and the outcome (solid red curve labeled "Baseline") and the fixed-effects for the entire subsample (dotted blue curve labeled "Fixed-effects", with the 95% confidence interval presented as shaded blue) in the subsample that only included first- and second-born siblings. The modeling results are consistent with those estimated in the full cohort. Figures in the right-hand column (b) show two conditional fixed-effects (CFE) models; one estimated on the sample of siblings for whom the first-born had shorter gestational age than the second-born (long-dash line labeled "First born earlier GA"). The other CFE model was estimated on the sample of siblings for whom the second born had shorter gestational age (dotted blue line labeled "Second-born shorter GA with 95% confidence region shaded dark grey").

Mortality

E9.1

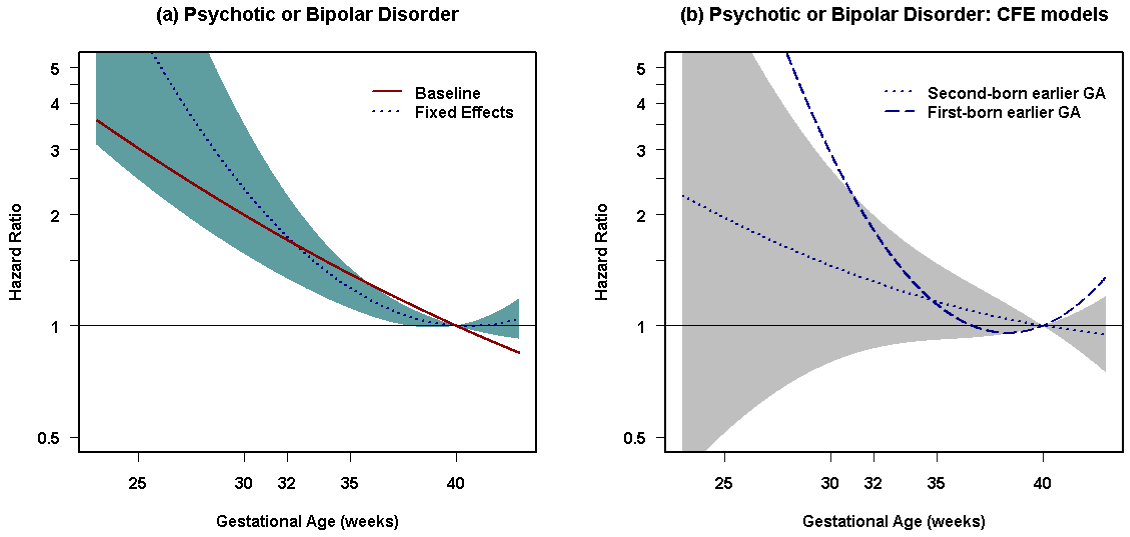


E9.2



Psychiatric Morbidity

E9.3



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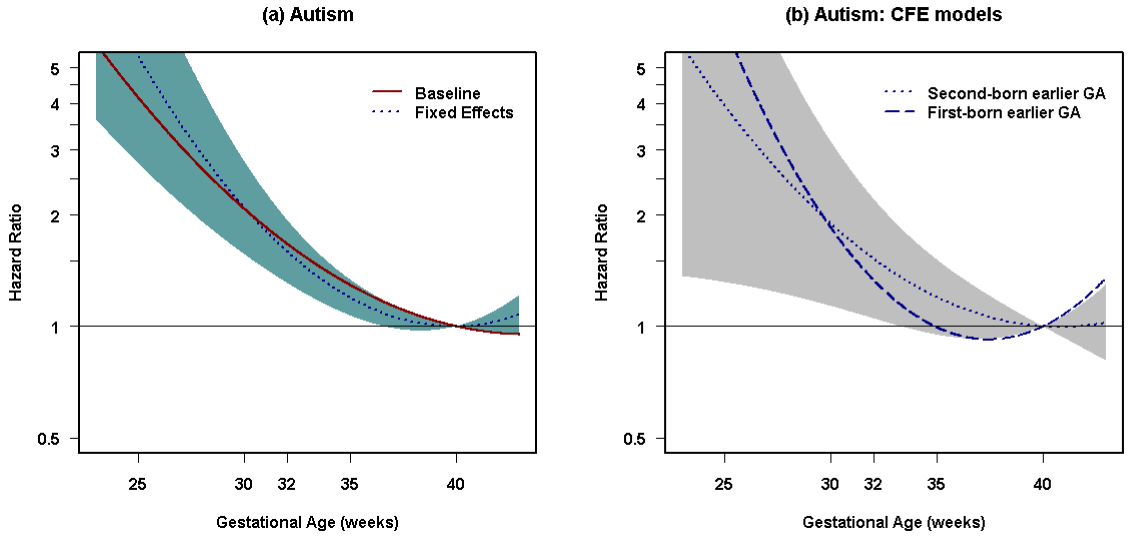
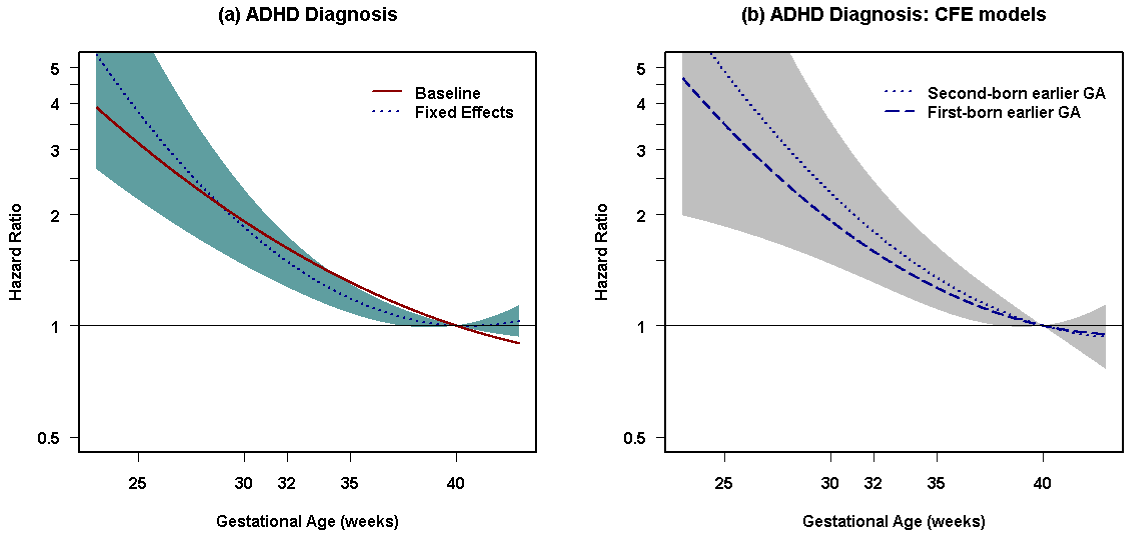
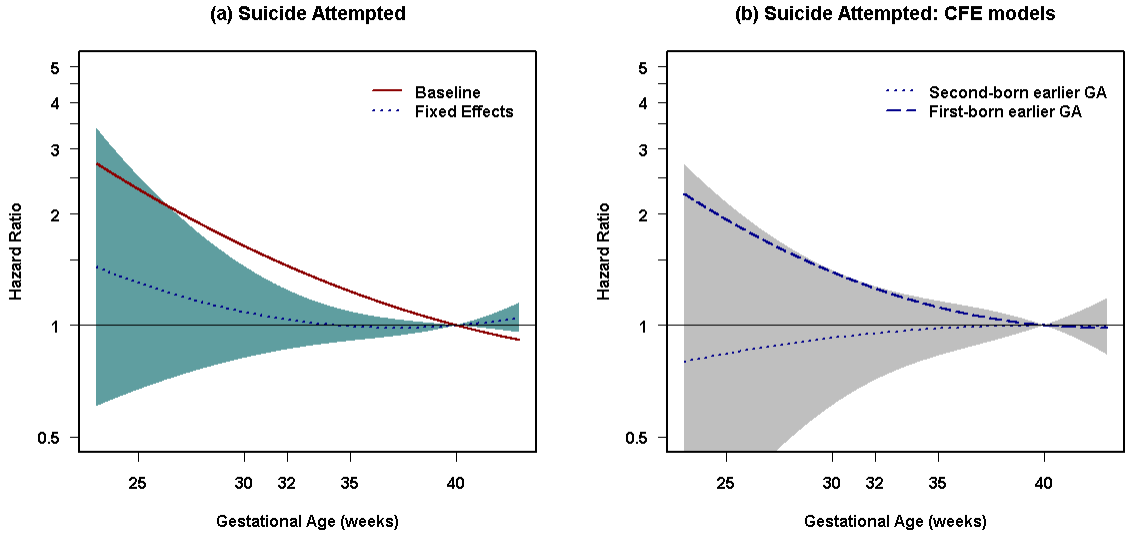


Psychiatric Morbidity (continued)

E9.5

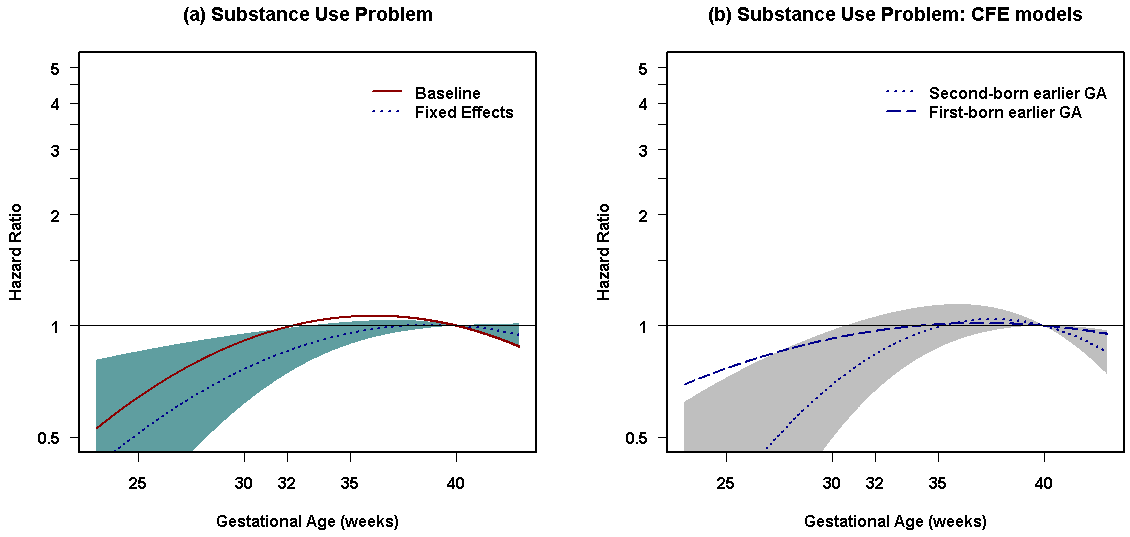


E9.6

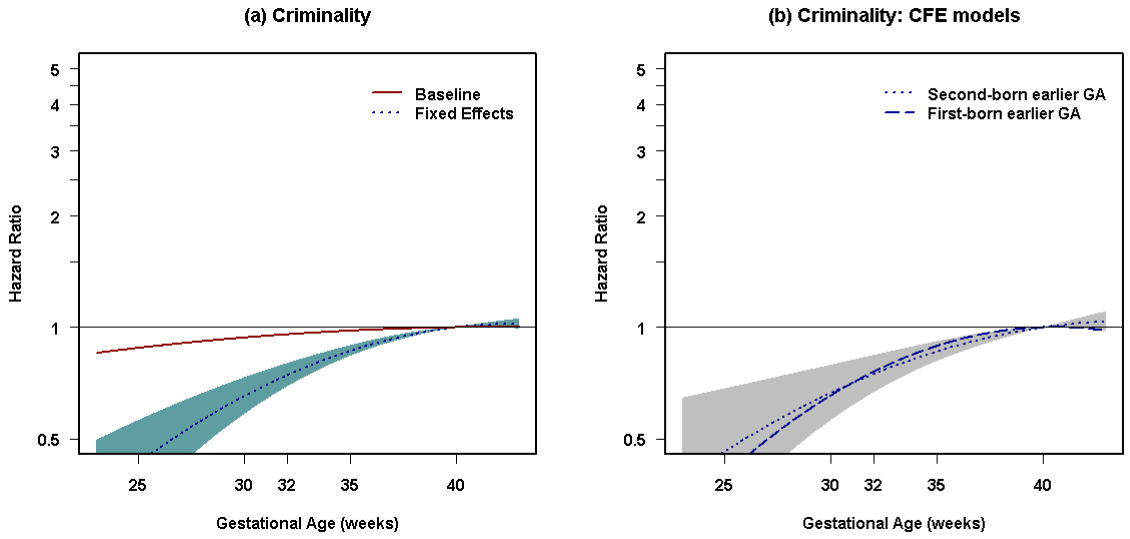


Psychiatric Morbidity (continued)

E9.7

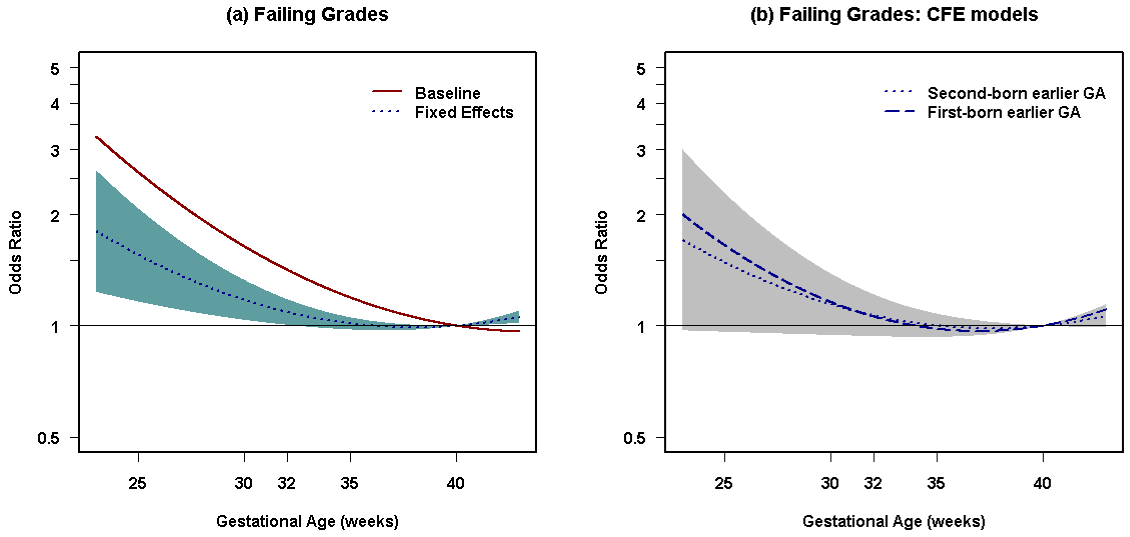


E9.8

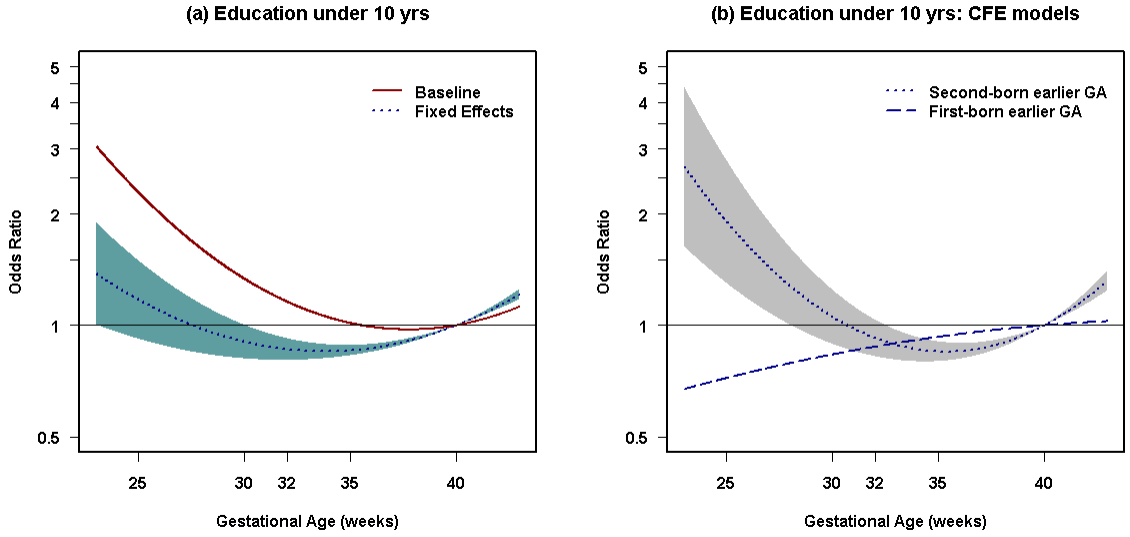


Academic Problems

E9.9

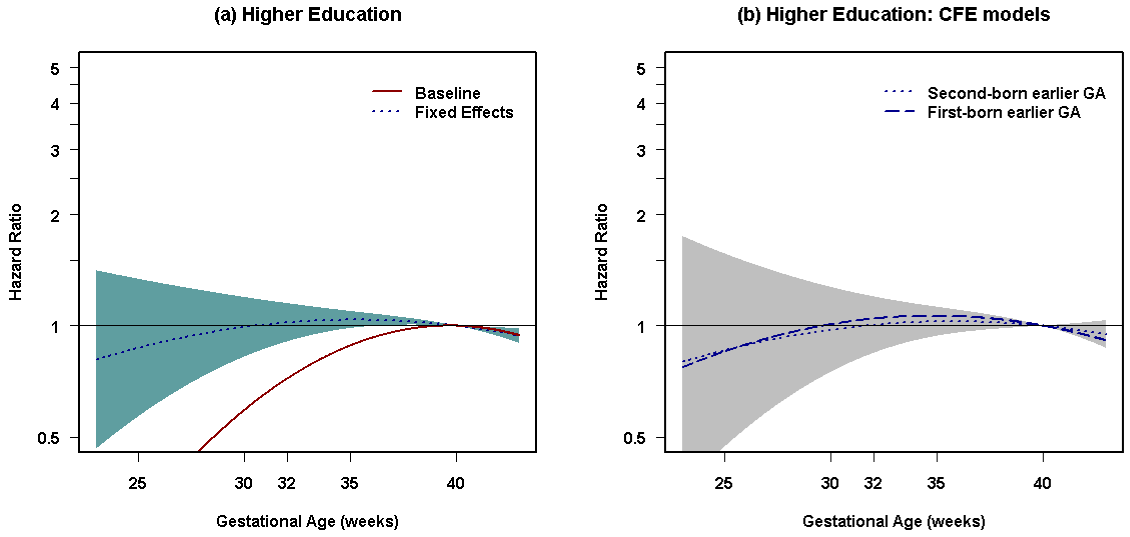


E9.10



Academic Problems (continued)

E9.11

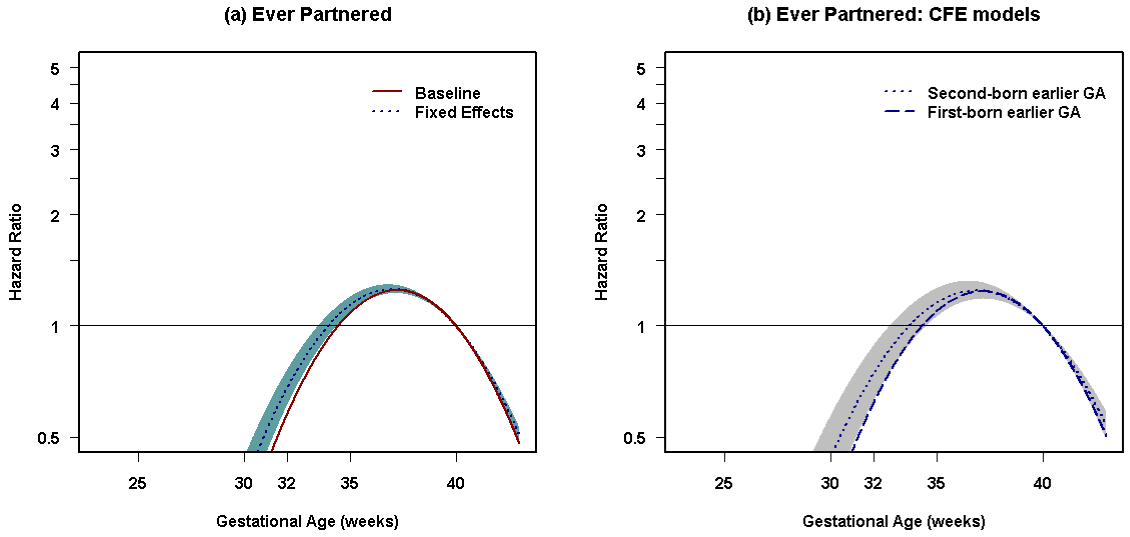


Social Adversity

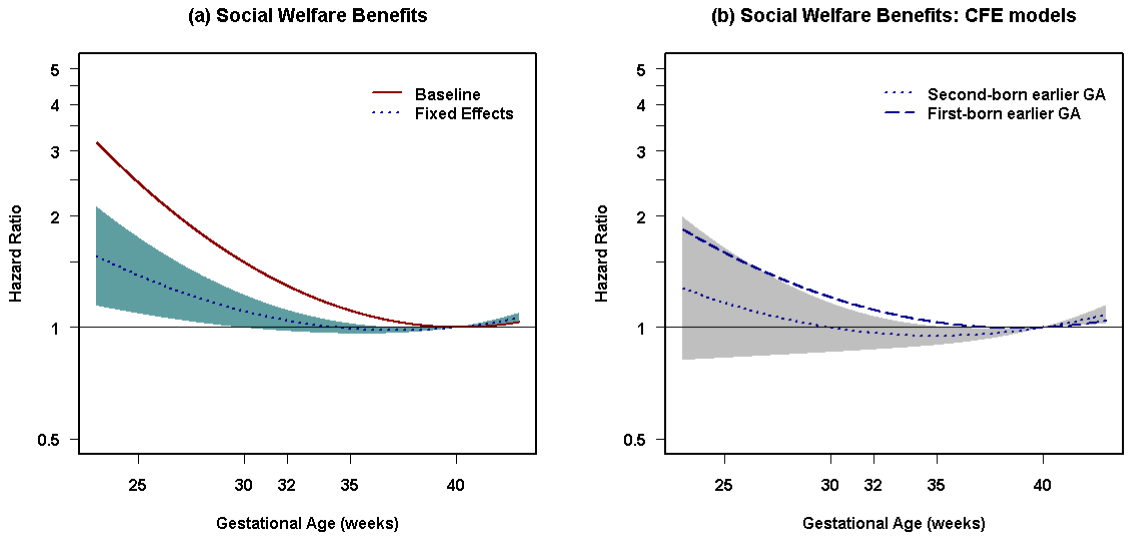
E9.12 Parenthood (problem with covariance matrix estimation)

Social Adversity (continued)

E9.13



E9.14



E10. Analyses exploring the moderating effect of year of birth on the association between gestational age and infant mortality.

We examined whether the association between gestational age and infant mortality has changed across the time span of the study to see if the results were consistent with previous research.[14] We fit the three main models in the main text (the baseline, adjusted, and fixed-effects models) while estimating the linear association between gestational age and infant mortality. Each model estimated the main effect of gestational age and an interaction between gestational age and year of birth. All of the models also included the main effect of year of birth.

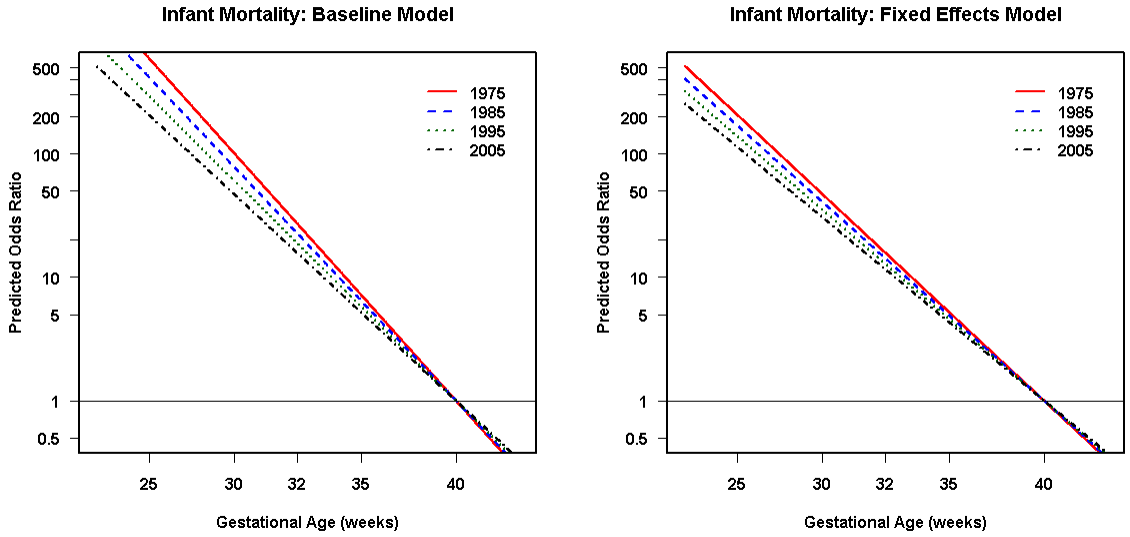
The model fitting results are presented in Table E10. To help with the interpretation we present the estimated Odds Ratios associated with gestational age for four years (1975, 1985, 1995, and 2005). As Figure E.9.1 illustrates the magnitude of the association between gestational age and infant mortality decreased across the time span, consistent with previous research.[14] Figure E.9.2 presents the association between gestational age and infant mortality for the four years using the parameters from the fixed-effects models. The results show the association between gestational age and infant mortality remains when controlling for selection factors shared by siblings and measured covariates, and the magnitude of the association decreased somewhat during the time span.

Table E10. Model fitting results from models exploring whether year of birth moderated the association between gestational age and infant mortality.

	Model 1			Model 2			Model 3		
Parameter	**b**	**SE**	**p**	**b**	**SE**	**p**	**b**	**SE**	**p**
Gestational age	-0.4449	0.0033	<0.0001	-0.4229	0.0035	<0.0001	-0.3704	0.0119	<0.0001
Gestational age*year of birth	0.0024	0.0002	<0.0001	0.0017	0.0002	<0.0001	0.0014	0.0007	0.0348

Note. Year of birth was referenced at 1973.

Figure E.9. Predicted odds ratio for infant mortality associated with gestational age by year of birth.



Note. Both figures present the predicted linear association between gestational age (referenced at 40 weeks) and infant mortality. The figures present the predicted odds ratios based on the baseline model (the left panel) and fixed-effects model (the right panel) for four years to illustrate the moderating effect of year of birth on the association between gestational age and year of birth.

E11. Comparison of the baseline and fixed-effects models with ordinal grouping of gestational age after dropping observations with extreme values on birth weight

The tables below present the unstandardized regression coefficients (with standard errors) and the point estimates (either Odds Ratios or Hazard Ratios, with the 95% confidence intervals) associated with the ordinal bins of gestational age. The models were based on a dataset that dropped an additional 8,935 offspring who were less than 6 standard deviations below the mean birth weight for the week of gestation or above 3 standard deviations above the mean birth weight for the week of gestation. The approach has been used by researchers before when analyzing gestational age in the Swedish Registers,[15] based on previous research suggesting that observations with extreme values in birth weight (relative to their gestational age) are errors.[16]

For all of the outcomes included in the study the results of the baseline and fixed-effects models based on the subset of the data are commensurate to those presented in the main text. The magnitude of the associations are comparable, with the point estimates all falling well within the confidence intervals of the estimates presented in Appendix 3.0. The confidence intervals around the point estimates for the binned analyses for parenthood are quite large in Table E11. As such, we reran the baseline and fixed effects models in the subset of the data using a quadratic model (considering GA to be continuous), and the results are commensurate with those presented in the main analyses (full results available upon request).

In sum, running the models on a subset of the data that excluded offspring with extreme values of birth weight relative to their gestational age provided commensurate results. The pattern of the associations and the magnitude of the point estimates were consistent with the main analyses.

Table E11.1 Maximum likelihood (ML) estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *mortality* outcomes.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Infant Mortality	Baseline	23-27	5.734	0.031	34098.386	<.0001	309.32	291.055	328.732
		28-30	4.333	0.031	19474.956	<.0001	76.19	71.692	80.971
		31-33	3.219	0.030	11690.960	<.0001	25.001	23.584	26.503
		34-36	1.913	0.025	5793.106	<.0001	6.771	6.445	7.112
	Fixed-effects	23-27	5.570	0.195	813.357	<.0001	262.308	178.888	384.629
		28-30	4.10	0.139	868.717	<.0001	60.041	45.728	78.834
		31-33	2.914	0.097	894.849	<.0001	18.425	15.223	22.3
		34-36	1.702	0.057	885.758	<.0001	5.487	4.905	6.138
Died After 1st Year	Baseline	23-27	1.1021	0.1926	32.736	<.0001	3.011	2.064	4.391
		28-30	0.8276	0.1234	44.974	<.0001	2.288	1.796	2.914
		31-33	0.7148	0.0739	93.647	<.0001	2.044	1.768	2.362
		34-36	0.437	0.0377	134.567	<.0001	1.548	1.438	1.666
	Fixed-effects	23-27	1.342	0.380	12.455	0.0004	3.827	1.816	8.064
		28-30	1.225	0.253	23.439	<.0001	3.404	2.073	5.59
		31-33	0.776	0.141	30.003	<.0001	2.172	1.646	2.867
		34-36	0.486	0.070	47.235	<.0001	1.626	1.416	1.868

Note. The GA (gestational age) reference group included offspring born between 37 weeks and 42 weeks and 6 days. For each group, the table lists the unstandardized regression coefficients (b), the standard error of the estimate (SE), Chi Square statistics, regression coefficients converted to either a hazard ratio (for all right-censored outcomes) or an odds ratio (for logistic outcomes), and 95% confidence limits on the point estimate of the model.

Table E11.2. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *psychiatric morbidity*.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Psychotic or Bipolar Disorder	Baseline	23-27	1.229	0.179	46.948	<.0001	3.418	2.405	4.858
		28-30	0.843	0.110	58.753	<.0001	2.324	1.873	2.883
		31-33	0.425	0.074	32.509	<.0001	1.531	1.323	1.773
		34-36	0.218	0.036	36.432	<.0001	1.244	1.159	1.335
	Fixed-effects	23-27	1.316	0.544	5.838	0.0157	3.731	1.282	10.856
		28-30	1.050	0.268	15.271	<.0001	2.86	1.688	4.845
		31-33	0.177	0.158	1.253	0.263	1.194	0.875	1.628
		34-36	0.112	0.075	2.213	0.1368	1.119	0.965	1.298
Autism	Baseline	23-27	1.273	0.127	99.708	<.0001	3.572	2.782	4.585
		28-30	0.817	0.130	39.146	<.0001	2.265	1.753	2.926
		31-33	0.471	0.097	23.490	<.0001	1.603	1.324	1.94
		34-36	0.338	0.048	48.08	<.0001	1.402	1.274	1.543
	Fixed-effects	23-27	1.551	0.466	11.049	0.0009	4.719	1.89	11.779
		28-30	1.289	0.363	12.579	0.0004	3.63	1.78	7.402
		31-33	0.310	0.252	1.516	0.2182	1.364	0.832	2.237
		34-36	0.307	0.126	5.900	0.0151	1.359	1.061	1.742
ADHD Diagnosis	Baseline	23-27	1.028	0.106	93.65	<.0001	2.797	2.271	3.445
		28-30	0.817	0.096	71.645	<.0001	2.265	1.874	2.737
		31-33	0.583	0.067	73.860	<.0001	1.793	1.569	2.048
		34-36	0.297	0.036	66.530	<.0001	1.347	1.254	1.447
	Fixed-effects	23-27	0.646	0.295	4.795	0.0285	1.91	1.07	3.407
		28-30	0.725	0.266	7.419	0.0065	2.067	1.226	3.485
		31-33	0.554	0.192	8.302	0.004	1.742	1.194	2.54
		34-36	0.077	0.097	0.634	0.4256	1.081	0.893	1.309
Suicide Attempt	Baseline	23-27	0.616	0.179	11.767	0.0006	1.852	1.302	2.634
		28-30	0.427	0.105	16.383	<.0001	1.533	1.247	1.886
		31-33	0.245	0.065	14.223	0.0002	1.278	1.125	1.452
		34-36	0.167	0.029	32.183	<.0001	1.182	1.116	1.252
	Fixed-effects	23-27	0.147	0.356	0.172	0.6778	1.159	0.577	2.33
		28-30	0.165	0.217	0.576	0.4478	1.18	0.77	1.807
		31-33	-0.163	0.125	1.68	0.1949	0.85	0.664	1.087
		34-36	0.006	0.055	0.012	0.9095	1.006	0.902	1.123
Substance Use Problem	Baseline	23-27	-0.707	0.176	15.986	<.0001	0.493	0.349	0.697
		28-30	0.082	0.085	0.927	0.3356	1.086	0.918	1.284
		31-33	0.076	0.053	2.056	0.1515	1.08	0.972	1.2
		34-36	0.067	0.024	7.593	0.0059	1.07	1.02	1.123
	Fixed-effects	23-27	-0.766	0.267	8.209	0.0042	0.465	0.275	0.785
		28-30	-0.292	0.146	3.960	0.0466	0.747	0.56	0.996
		31-33	-0.091	0.094	0.938	0.3327	0.913	0.759	1.098
		34-36	-0.116	0.043	7.100	0.0077	0.89	0.817	0.97
Criminality	Baseline	23-27	-0.402	0.092	18.923	<.0001	0.669	0.558	0.802
		28-30	-0.052	0.042	1.554	0.2124	0.949	0.874	1.03
		31-33	-0.036	0.023	2.396	0.1216	0.964	0.921	1.01
		34-36	0.024	0.010	5.900	0.0151	1.025	1.005	1.045
	Fixed-effects	23-27	-0.443	0.158	7.865	0.005	0.642	0.471	0.875
		28-30	-0.356	0.080	19.876	<.0001	0.7	0.598	0.819
		31-33	-0.193	0.044	19.101	<.0001	0.824	0.756	0.899
		34-36	-0.102	0.019	28.426	<.0001	0.903	0.87	0.937

Note. See note on Table E11.1

Table E11.3. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *academic problems*.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Failing Grades	Baseline	23-27	0.735	0.073	100.735	<.0001	2.086	1.807	2.408
		28-30	0.495	0.041	146.286	<.0001	1.642	1.515	1.779
		31-33	0.264	0.024	115.562	<.0001	1.302	1.241	1.367
		34-36	0.188	0.011	293.048	<.0001	1.207	1.182	1.234
	Fixed-effects	23-27	0.818	0.169	23.425	<.0001	2.267	1.627	3.157
		28-30	0.208	0.089	5.483	0.0192	1.232	1.035	1.467
		31-33	-0.014	0.049	0.086	0.7683	0.985	0.894	1.087
		34-36	-0.047	0.022	4.448	0.0349	0.954	0.913	0.997
Education under 10 yrs	Baseline	23-27	0.533	0.068	59.950	<.0001	1.705	1.489	1.951
		28-30	0.270	0.037	51.177	<.0001	1.311	1.217	1.412
		31-33	0.120	0.021	30.137	<.0001	1.128	1.08	1.177
		34-36	0.069	0.009	51.013	<.0001	1.072	1.051	1.092
	Fixed-effects	23-27	0.362	0.139	6.755	0.0093	1.436	1.093	1.887
		28-30	-0.037	0.076	0.237	0.6264	0.963	0.828	1.12
		31-33	-0.133	0.044	9.099	0.0026	0.875	0.803	0.954
		34-36	-0.155	0.019	63.766	<.0001	0.856	0.824	0.889
Higher Education	Baseline	23-27	-0.575	0.135	18.118	<.0001	0.563	0.432	0.733
		28-30	-0.382	0.060	40.589	<.0001	0.682	0.606	0.767
		31-33	-0.241	0.031	58.405	<.0001	0.786	0.739	0.836
		34-36	-0.155	0.013	137.348	<.0001	0.856	0.834	0.878
	Fixed-effects	23-27	-0.848	0.351	5.832	0.0157	0.428	0.215	0.852
		28-30	0.198	0.152	1.688	0.1938	1.219	0.904	1.645
		31-33	0.085	0.081	1.114	0.2911	1.089	0.929	1.277
		34-36	-0.003	0.033	0.013	0.9068	0.996	0.933	1.063

Note. See note on Table E11.1

E11.4. ML estimates for the baseline and fixed-effects models with ordinal gestational age (GA) predicting offspring *social adversity*. The GA reference bin included offspring born between 37 weeks and 42 weeks and 6 days.

Outcome	Model	GA Category (wks)	b	SE	ChiSq	Pr > ChiSq	Point Estimate	95% CL Lower	95% CL Upper
Parenthood	Baseline	23-27	-0.143	0.083	2.932	0.086	0.867	0.736	1.021
		28-30	-0.059	0.036	2.609	0.106	0.942	0.876	1.013
		31-33	-0.065	0.019	11.164	0.000	0.936	0.901	0.973
		34-36	0.025	0.008	9.619	0.001	1.026	1.009	1.042
	Fixed-effects	23-27	-0.158	0.212	0.557	0.455	0.853	0.562	1.294
		28-30	-0.239	0.101	5.501	0.019	0.787	0.645	0.961
		31-33	-0.245	0.054	20.453	<.0001	0.782	0.704	0.87
		34-36	-0.142	0.022	39.368	<.0001	0.867	0.83	0.907
Ever Partnered	Baseline	23-27	-1.624	0.130	155.791	<.0001	0.197	0.153	0.254
		28-30	-0.544	0.054	98.891	<.0001	0.58	0.521	0.646
		31-33	-0.150	0.029	26.682	<.0001	0.86	0.813	0.911
		34-36	0.104	0.011	76.601	<.0001	1.11	1.084	1.136
	Fixed-effects	23-27	-1.914	0.239	63.999	<.0001	0.147	0.092	0.236
		28-30	-0.777	0.113	46.545	<.0001	0.459	0.367	0.574
		31-33	-0.270	0.066	16.707	<.0001	0.763	0.67	0.869
		34-36	-0.003	0.028	0.013	0.9073	0.997	0.942	1.054
Social Welfare Benefits	Baseline	23-27	0.242	0.062	14.965	0.0001	1.274	1.127	1.441
		28-30	0.300	0.032	86.155	<.0001	1.35	1.267	1.439
		31-33	0.227	0.018	149.652	<.0001	1.256	1.211	1.303
		34-36	0.154	0.008	337.723	<.0001	1.167	1.148	1.186
	Fixed-effects	23-27	0.201	0.132	2.312	0.128	1.223	0.944	1.585
		28-30	-0.000	0.068	0	0.994	1	0.874	1.143
		31-33	-0.056	0.038	2.133	0.144	0.945	0.875	1.02
		34-36	-0.003	0.017	0.032	0.857	0.997	0.964	1.031

Note. See note on Table E11.1

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