

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix 1. Descriptive Statistics by Paternal Age at Childbearing Subgroups

Covariates	Birth Year	N	Statistic	Paternal Age, yrs (n)												Entire Population			
				< 20 (24,257)	20-24 (359,691) REFERENCE		25-29 (996,096)		30-34 (1,040,222)		35-39 (560,192)		40-44 (206,842)		≥ 45 (90,825)		n ^a	%	
Offspring	1973-2001	2,615,081																	
Female ^a			(n, %) ^a	11,722	48.32	173,863	48.34	481,788	48.37	503,055	48.36	271,366	48.44	100,552	48.61	43,912	48.35	1,264,248	48.34
Second born			(n, %)	1,699	7.00	83,019	23.08	375,651	37.71	436,768	41.99	211,303	37.72	68,752	33.24	28,582	31.47	963,970	36.86
Third born			(n, %)	267	1.10	12,707	3.53	91,248	9.16	182,450	17.54	137,387	24.52	49,237	23.80	18,103	19.93	402,855	15.41
Fourth born or higher			(n, %)	106	0.44	3,198	0.89	22,576	2.27	56,826	5.46	64,091	11.44	36,322	17.56	17,565	19.34	163,263	6.24
Paternal	1904-1987	1,408,669																	
Nationality (Swedish)			(n, %)	20,373	83.99	313,620	87.19	884,444	88.79	911,720	87.65	469,386	83.79	161,973	78.31	66,350	73.05	2,291,415	87.62
Upper Secondary Education (min 3 yrs)			(n, %)	5,193	21.81	112,774	31.58	442,488	44.62	544,769	52.56	294,921	52.88	104,443	50.81	43,425	48.51	1,122,661	42.93
Severe Adult Psychopathology			(n, %)	774	3.19	7,157	1.99	14,831	1.49	14,264	1.37	8,672	1.55	4,159	2.01	2,257	2.48	46,670	1.78
Criminality (any)			(n, %)	15,669	64.60	174,580	48.54	383,315	38.48	367,822	35.36	206,667	36.89	82,797	40.03	39,015	42.96	1,041,427	39.82
Father's Age at Birth (yrs) ^b			(M,SD) ^b															31.27	5.96
Father's Age at Birth of First Child (yrs)			(M,SD)															28.92	5.54
Disposable Income at Birth		895,833	(M,SD)	25.43	25.03	32.74	18.17	43.08	18.61	50.17	22.06	52.95	24.65	52.77	26.15	51.11	28.06	47.22	22.72
Maternal	1924-1987	1,404,484																	
Nationality (Swedish)			(n, %)	21,129	87.17	320,461	89.16	894,724	89.89	918,001	88.32	470,399	84.05	160,205	77.54	62,376	68.78	2,308,587	88.28
Upper Secondary Education (min 3 yrs)			(n, %)	6,634	27.71	145,066	40.54	532,896	53.67	637,474	61.48	344,768	61.82	120,935	58.87	50,783	56.56	1,336,236	51.10
Severe Adult Psychopathology			(n, %)	761	3.14	7,489	2.08	15,567	1.56	15,330	1.47	9,099	1.62	4,000	1.93	2,283	2.51	48,524	1.86
Criminality (any)			(n, %)	6,396	26.37	57,904	16.10	110,411	11.08	101,349	9.74	58,757	10.49	24,729	11.96	12,567	13.84	306,779	11.73
Mother's Age at Birth (yrs)			(M,SD)	19.47	2.65	22.71	3.10	26.34	3.37	29.85	3.63	32.77	4.09	34.71	4.67	35.55	5.18	28.42	5.09
Psychiatric Morbidity																			
Autism ^c	1992-2001	900,337	(n, K-M est) ^c	10	0.19	173	0.23	537	0.20	818	0.28	524	0.32	215	0.34	148	0.50	2,424	0.27
ADHD Diagnosis ^c	1992-2001	900,337	(n, K-M est) ^c	46	0.89	386	0.51	802	0.31	817	0.28	490	0.30	211	0.33	112	0.38	2,861	0.32
Psychosis ^d	1973-1997	2,291,967	(n, K-M est) ^d	179	1.48	1,618	0.89	3,372	0.19	3,029	0.86	1,587	1.00	597	1.16	357	1.55	10,739	0.89
Bipolar Disorder ^d	1973-1997	2,292,959	(n, K-M est) ^d	88	0.81	990	0.58	2,172	0.54	1,986	0.61	1,021	0.74	373	0.81	189	0.85	6,819	0.61
Suicide Attempt ^d	1973-1997	2,293,032	(n, K-M est) ^d	630	5.05	5,429	2.81	9,555	2.08	7,595	2.00	3,787	2.19	1,431	2.50	721	2.88	29,148	2.24
Substance Use Problem ^d	1973-1997	2,293,032	(n, K-M est) ^d	839	6.25	8,055	3.92	14,165	2.84	11,487	2.69	5,686	2.92	2,102	3.26	1,043	3.63	43,377	3.04
Academic Achievement																			
Failing Grades	1973-1992	1,767,091	(n, %)	5488	34.88	53550	21.62	88097	14.52	65433	12.44	32561	13.05	12847	14.99	6156	17.37	264132	14.95
Education under 10 yrs	1973-1991	1,679,921	(n, %)	7113	46.13	82777	34.53	160388	27.74	130301	26.09	66896	28.58	26035	32.51	11339	34.27	484799	28.86
Higher Education	1973-1983	906,458	(n, %)	1248	12.44	31121	21.57	108042	32.23	95492	36.4	37125	35.03	10608	32.25	4738	30.28	288374	31.81
Low IQ (males)	1973-1992	641,020	(n, %)	1036	17.91	11974	13.16	21658	9.73	16318	8.71	7428	8.91	2676	9.90	1230	10.82	62646	9.77

Note. ^an = number of identified cases; % = percentage of cases, ^bM = mean; SD = standard deviation, ^cM est = Kaplan-Meier product-limit survival estimate by the age of 15 years, ^dKaplan-Meier estimate for first occurrence by 30 years of age.

eAppendix 2. Correlation Between Paternal Age at Birth of First Child and Parental Covariates

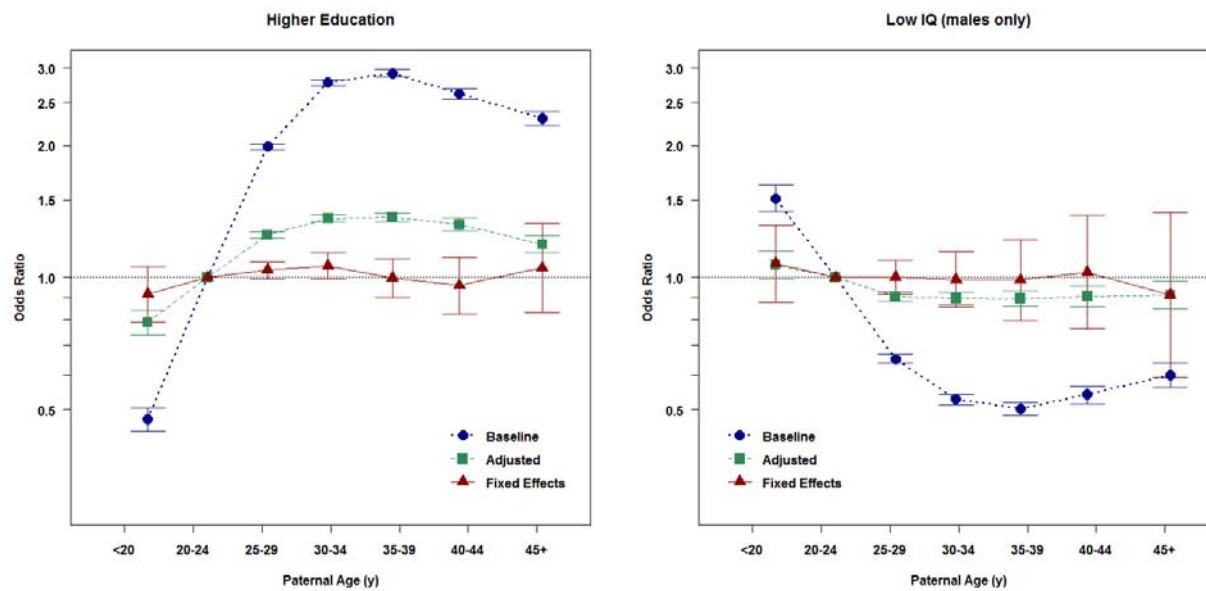
The correlations between paternal age at birth of first child and parental covariates computed in the sample of 1,408, 669 distinct fathers. The tetrachoric correlations used a binary representation of paternal age at first child that was dichotomized at the mean paternal age at first child (28.92 years). The effective sample size for correlations with disposable family income was n=895,833. All of the analyses were conducted using SAS.

eTable B.1 Correlations between paternal age at birth of first child and parental covariates.

	Correlation Statistic		
	Tetrachoric		Pearson
	Value	ASE ^a	Value
Paternal covariates			
Nationality (Swedish)	-0.131	0.001	.
Upper Secondary Education (min 3 yrs)	0.244	0.001	.
Severe Adult Psychopathology	0.005	0.002	.
Criminality (any)	-0.079	0.001	.
Disposable Income at Birth (percentile)	0.212	0.002	0.165
Maternal covariates			
Nationality (Swedish)	-0.078	0.001	.
Upper Secondary Education (min 3 yrs)	0.109	0.001	.
Severe Adult Psychopathology	0.005	0.001	.
Criminality (any)	-0.072	0.001	.
Maternal Age at Birth	0.591	0.001	0.530

^a = Asymptotic Standard Error (ASE)

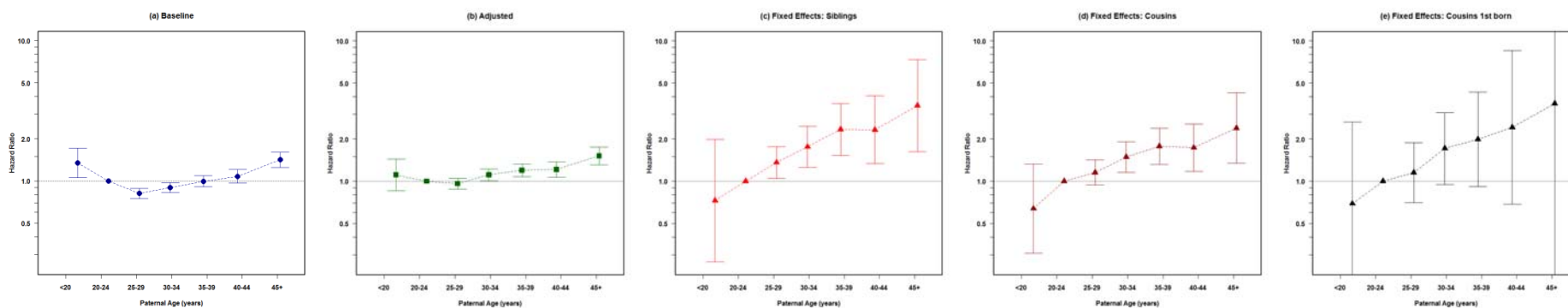
eAppendix 3. Baseline, Adjusted, and Fixed-Effects Results for Additional Indexes of Academic Morbidity



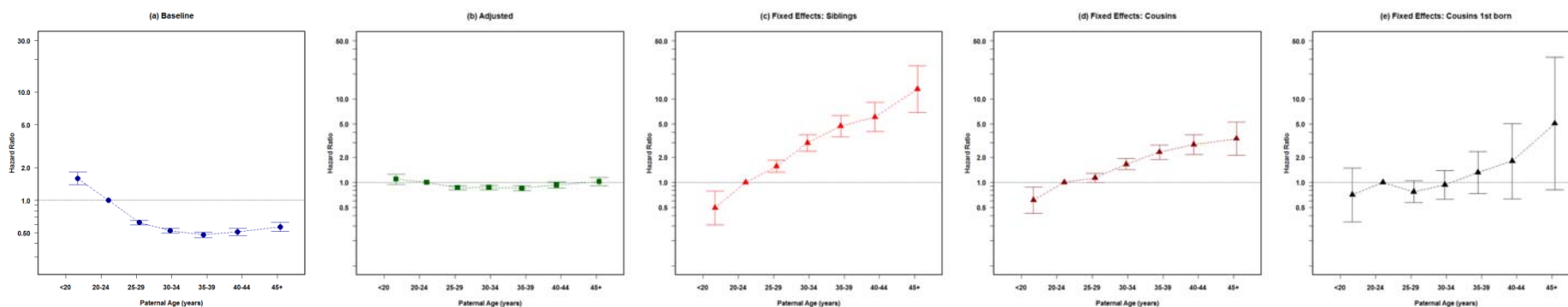
eAppendix 4. Comparison of Baseline, Adjusted, Sibling-Comparison, Cousin-Comparison, and First-Born Cousin-Comparison Models

The Figures present the association between paternal age at child-bearing (PAC) and each outcome for the (a) baseline, (b) adjusted, (c) sibling-comparison, (d) cousin-comparison, and (e) first-born cousin-comparison models. The results of the ordinal models are presented with the point estimates and 95% confidence intervals as hash tags. The Table presents the sample sizes of offspring, fathers, and paternal grandfathers who contributed to the sibling fixed effects, cousin fixed effects, and first-born cousin fixed effects analyses.

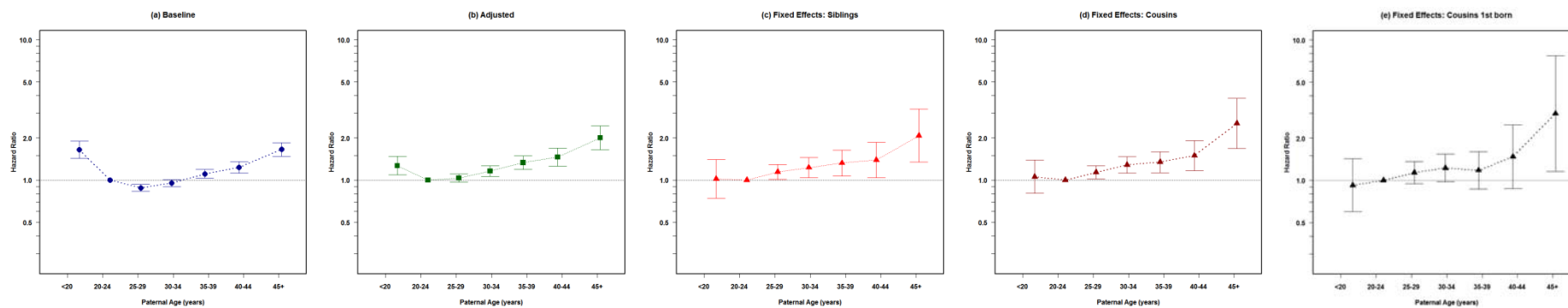
Association Between Advancing Paternal Age and Autism



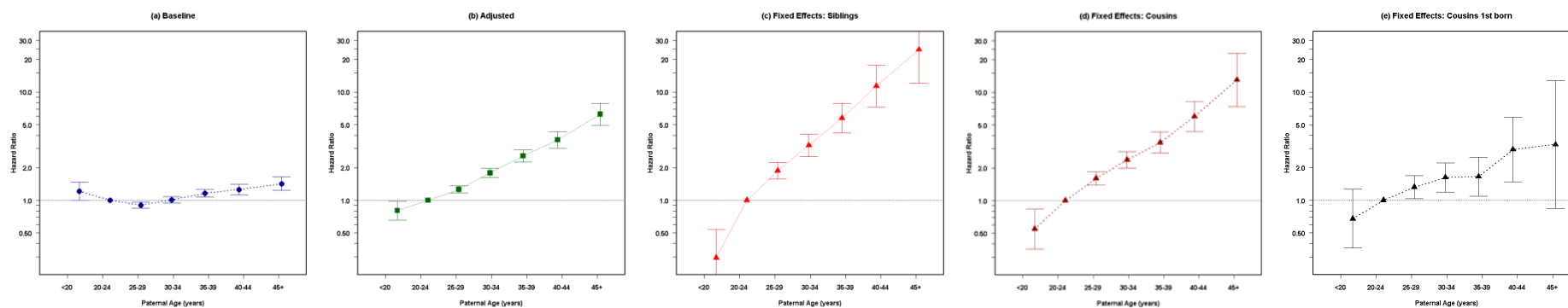
Association Between Advancing Paternal Age and ADHD Diagnosis



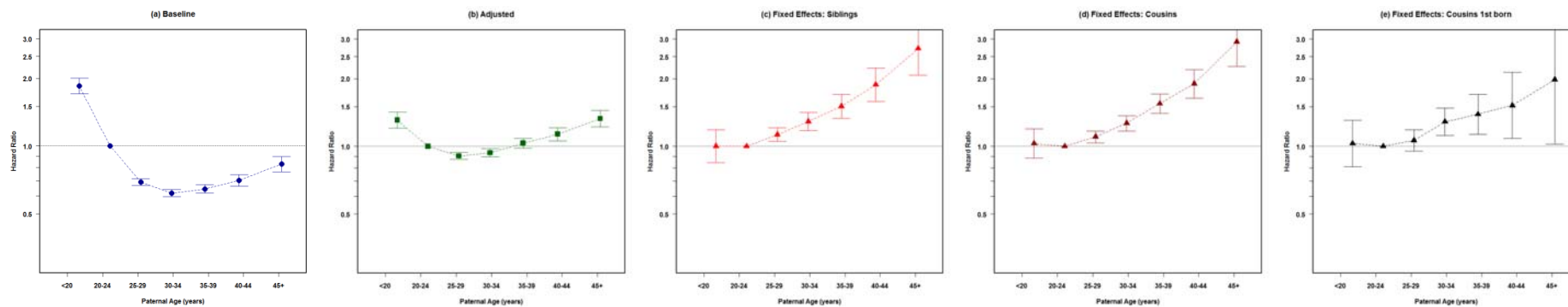
Association Between Advancing Paternal Age and Psychosis



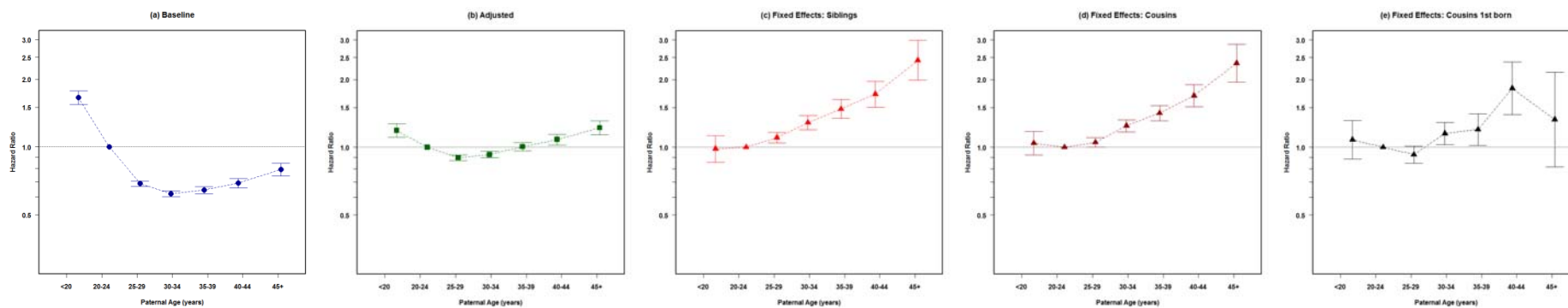
Association Between Advancing Paternal Age and Bipolar Disorder



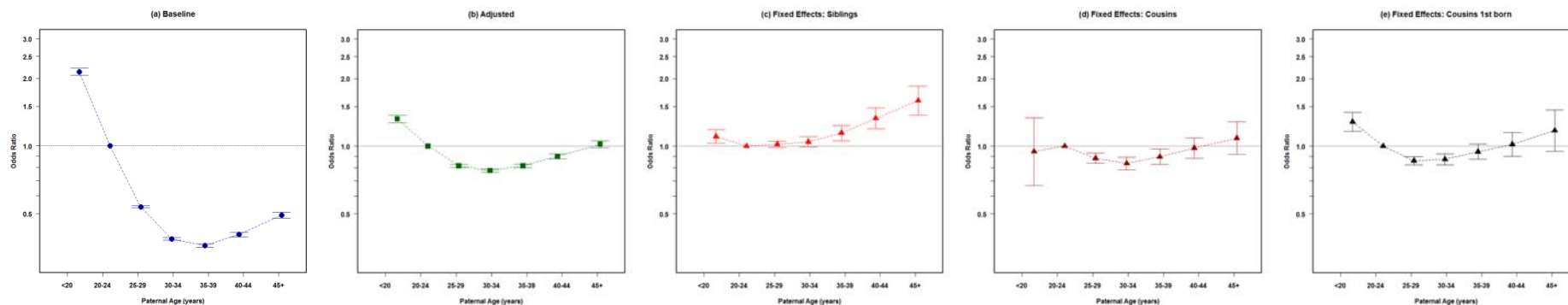
Association Between Advancing Paternal Age and Suicide Attempt



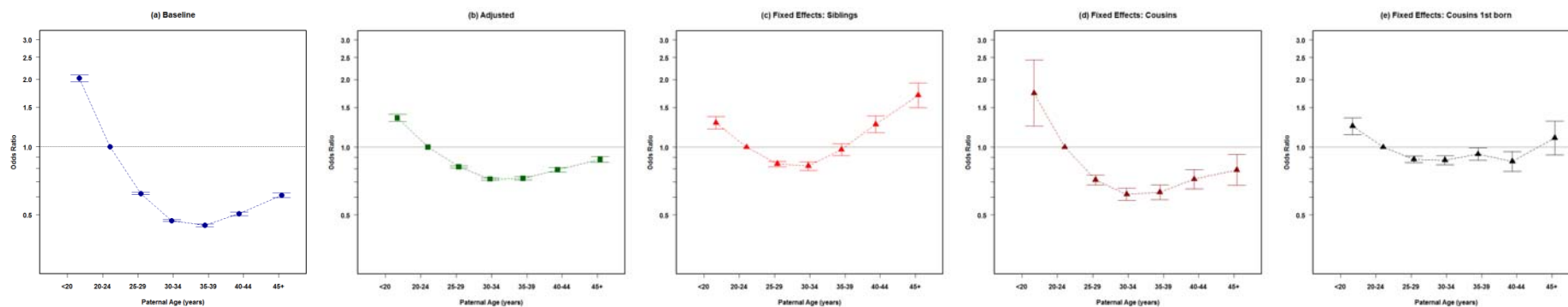
Association Between Advancing Paternal Age and Substance Use Problems



Association Between Advancing Paternal Age and Failing Grades



Association Between Advancing Paternal Age and Low Educational Attainment



eTable. The Sample Sizes of Offspring, Fathers, and Paternal Grandfathers Who Contributed to the Sibling Fixed Effects, Cousin Fixed Effects, and First-Born Cousin Fixed Effects Analyses

Outcome	Birth Year	Fixed Effects Models	Number of distinct identifiers		
			Offspring	Fathers	Paternal Grandfathers
Psychiatric Morbidity					
Autism & ADHD	1992-2001	Siblings	537,274	249,041	199,227
		Cousins (all)	226,792	149,671	70,735
		Cousins (first-born)	68,370	68,370	33,051
Psychosis	1973-1997	Siblings	1,699,376	734,226	536,353
		Cousins (all)	888,843	458,402	204,594
		Cousins (first-born)	458,142	458,142	204,466
Bipolar Disorder	1973-1997	Siblings	1,768,310	734,732	536,612
		Cousins (all)	889,219	458,446	204,594
		Cousins (first-born)	458,434	458,434	204,586
Suicide Attempt	1973-1997	Siblings	1,705,587	734,325	536,396
		Cousins (all)	856,227	447,964	204,344
		Cousins (first-born)	434,957	434,957	194,442
Substance Use Problem	1973-1997	Siblings	1,763,585	734,724	536,607
		Cousins (all)	886,849	458,049	204,594
		Cousins (first-born)	456,427	456,427	203,760
Academic Achievement					
Failing Grades	1973-1992	Siblings	1,294,873	562,808	422,977
		Cousins (all)	657,018	362,637	164,550
		Cousins (first-born)	350,429	350,429	157,503
Education under 10 yrs	1973-1991	Siblings	1,208,605	523,488	395,749
		Cousins (all)	614,443	343,160	155,069
		Cousins (first-born)	336,245	336,245	151,134
Higher Education	1973-1983	Siblings	519,151	243,163	195,065
		Cousins (all)	266,667	178,463	82,345
		Cousins (first-born)	175,386	175,386	80,454
Low IQ (males)	1973-1992	Siblings	474,954	349,407	279,268
		Cousins (all)	243,302	191,474	128,438
		Cousins (first-born)	69,829	69,829	33,267