The Older, the Better? The Causal Effects of Parental Ages on Children's Educational Performance

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1. Motivation and Study Aims

During the 20th century, there has been an increase in the ages at which parents have children. The age at first birth of women has increased between four to five years in nearly all developed countries (Mills, Rindfuss, McDonald, & te Velde, 2011). The consequences of this demographic shift are of great interest to policy makers, the public, and various scientific disciplines. In particular, parents and their offspring seem to face a trade-off between negative biological and positive socioeconomic consequences of delays in parental ages at birth.

On the one hand, epidemiological research has shown that children of older parents are at a higher risk of a low birth weight and to develop symptoms of mental health conditions such as autism and schizophrenia (Bornstein, Putnick, Suwalsky, & Gini, 2006; Cohen, 2014; Jacobsson, Ladfors, & Milsom, 2004; Khoshnood, Wall, & Lee, 2005). On the other hand, numerous sociological studies have documented a positive association between higher parental ages and children's educational outcomes (Barclay & Myrskylä, 2016; Duncan, Lee, Rosales-Rueda, & Kalil, 2018; Fishman & Min, 2018; Grätz, 2018; Kalmijn & Kraaykamp, 2005; Leigh & Gong, 2010; Mare & Tzeng, 1989; Powell, Steelman, & Carini, 2006). A crucial question is whether such associations are causal. Only if parental ages causally influence children's educational outcomes, a shift in the distribution of ages will lead to improved educational attainment at the population level.

Our study contributes to this research by using a novel approach to estimate the causal effects of maternal and paternal ages on children's educational performance. Previous research relied on family fixed effects models to estimate the effects of parental ages on child education (Barclay & Myrskylä, 2016; Duncan et al., 2018; Fishman & Min, 2018; Grätz, 2018; Kalmijn

& Kraaykamp, 2005). The interpretation of these estimates as causal has, however, been questioned due to the challenge of disentangling the effects of parental ages in family fixed effects models from unobserved confounding variables (Keiding & Andersen, 2016; Kravdal, 2019).

We employ instrumental variable estimation to estimate the effects of maternal and paternal ages on their offspring's educational performance. We apply Mendelian randomization (MR), leveraging the random assortment of genes influencing the age at first birth of men and women as instrumental variables for maternal and paternal ages (Mills, Barban, & Tropf, 2020). We avoid problems of genetic confounding in MR IV analysis by only using genes of parents for constructing the polygenic scores of age at first birth, which parents have not transmitted to their children.

2. Hypotheses

Our study tests the hypothesis whether maternal and paternal ages causally affect children's educational performance (H1).

We also test H2 according to which the effects of maternal age on child education are larger than the effects of paternal age on child education.

H3 predicts that the causal effect of maternal and paternal ages on educational performance is larger for boys than for girls.

Finally, we test H4 according to which the effects of maternal and paternal ages on child education are larger for children with low than for children with highly educated parents.

3. Sample Selection and Measures

In order to test our four hypotheses, we use Norwegian register data. These registry data allow us to avoid several recently highlighted issues of sample selection and resulting ascertainment bias (Abdellaoui & Verweij, 2021). The sample is restricted to a cohort of children born between 2001 and 2008 in Norway. The sample is limited to first-born children to control for the confounding influence of birth order (Härkönen, 2014). These sample selection criteria results in a size of the analytical sample of approximately 11,000 trios of children, mothers, and fathers.

We measure children's academic performance using national standardized tests in Maths, Reading, English in 5th (~age 10), 8th (~age 14) and 9th grade (~age 15). We analyze a measure combing information (standardizing by age) from different ages and, as a robustness check, separately by age. However, we have no theoretical expectations that the effects of parental ages on children's academic performance should vary by child age. At all ages, we average across subjects. We standardize the test scores within each birth year.

Our instrumental variables are the polygenic scores of maternal and paternal ages at first birth (Mills, Tropf, et al., 2020). We only use those genes of parents, which were not transmitted to their children to avoid genetic confounding.

In all models, we control for child sex and the first 20 genetic principal components to adjust for population stratification. Child sex is a dummy variable which is one for male and zero for female children. In addition, we report separate results for male and for female children.

In the final part of the analysis, we compare children with low (no parent has a university degree) to children with highly educated (at least one parent has a university degree) parents.

4. Preliminary Results

Table 1 reports the first results we have obtained using our IV approach. We compare the IV to the OLS estimates. We report separate results mother's age (Models 1 and 2) and father's age (Model 3 and 4).

Table 1: OLS and IV regression of child school performance on parental age at birth with controls

	OLS Mother	IV Mother	OLS Father	IV Father
(Intercept)	0.102 ***	-0.052	0.108 ***	-0.543 **
	(0.013)	(0.071)	(0.015)	(0.181)
mothers_age	0.037 ***	0.078 ***		
	(0.002)	(0.019)		
child_sex	0.025	0.033 *	0.026	0.033
	(0.015)	(0.016)	(0.015)	(0.019)
fathers_age			0.022 ***	0.133 ***
			(0.002)	(0.031)
N	11054	10534	11054	10534
R2	0.036	-0.009	0.016	-0.369
logLik	-13229.340		-13342.931	
AIC	26466.681		26693.862	

*** p < 0.001; ** p < 0.01; * p < 0.05.

Column names: names, OLS Mother, IV Mother, OLS Father, IV Father

The (preliminary) results show that there are causal effects of both mother's and father's age. In fact, the IV estimates are considerably larger than the OLS estimates. An increase in maternal age by ten years, increases children's GPA by 0.78 standard deviations. These findings support H1. We find no support for H2, however, as the effects of father's age are even larger than the effects of mother's age. An increase in father's age by ten years leads to a 1.33 standard deviation increase in child GPA.

5. Discussion and Conclusion

The results of our study underline the positive socioeconomic consequences of delays in parental ages at first birth. Whilst previous research has argued positive effects of parental ages found in family fixed effects models are largely due to period effects (Barclay and Myrskylä 2016), we have controlled for period effects through standardizing GPA within each cohort. Our results are therefore due to real consequences of increases in parental resources associated with increasing parental ages. These findings provide new causal evidence to the old idea that parental ages are important for children's life chances.

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