Intergenerational transmission of education and ADHD

Effects of parental genotypes

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Background

It is challenging to study whether children resemble their parents due to nature, nurture, or a mixture of both.

Method

Parents transmit 50% of their alleles to their offspring. The combined trait-specific effect of these alleles are summarized in a polygenic score (PGS). Likewise, we can calculate a PGS for alleles that were not transmitted. They can only affect offspring through the environment, via genetically influenced behaviours in the parents, called *genetic nurturing*. For genotyped mother-father-offspring trios (1,120-2,518 per analysis) we calculated transmitted and non-transmitted PGSs for adult educational attainment (EA) and childhood ADHD, and tested if these predicted and school success and ADHD in offspring.

Results

In adults, both transmitted (R^2 = 7.6%) and non-transmitted (R^2 = 1.7%) EA-PGSs predicted offspring EA, evidencing genetic nurturing. In 12-year olds, academic achievement was predicted only by transmitted EA-PGSs (R^2 = 5.7%), but we did not find genetic nurturing (R^2 ~ 0.1%). The ADHD-PGSs did not predict academic achievement (R^2 ~ 0.6%). ADHD symptoms in children were predicted by transmitted EA-PGSs and ADHD-PGSs (R^2 = 1-2%).

Conclusion

Previously reported associations between parent characteristics and offspring outcomes seem to be mainly a marker of genetic effects shared by parents and children. S

Genes of parents shape children's environment, impacting school success in adulthood, but not yet in childhood.
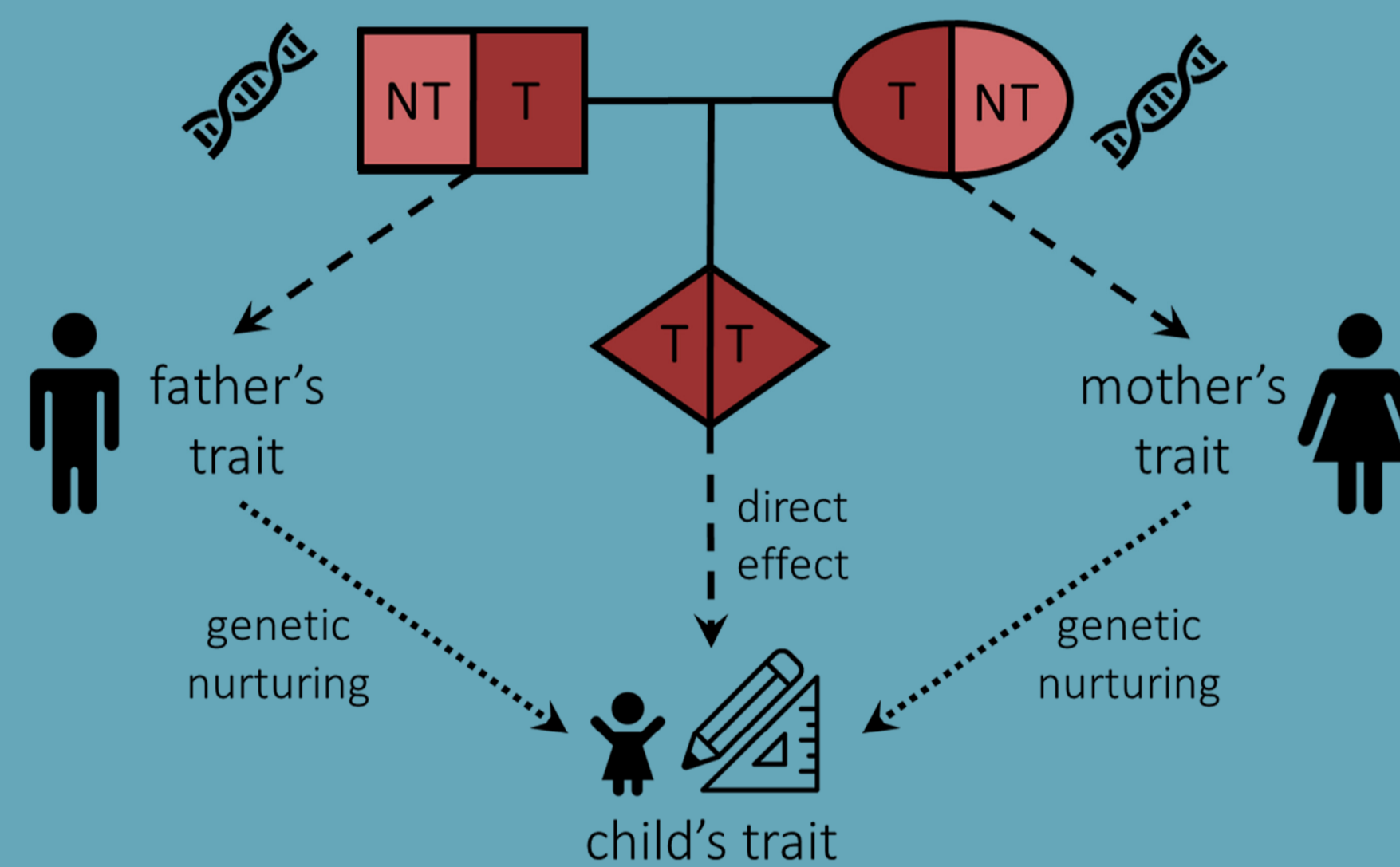
T = transmitted

NT = not transmitted

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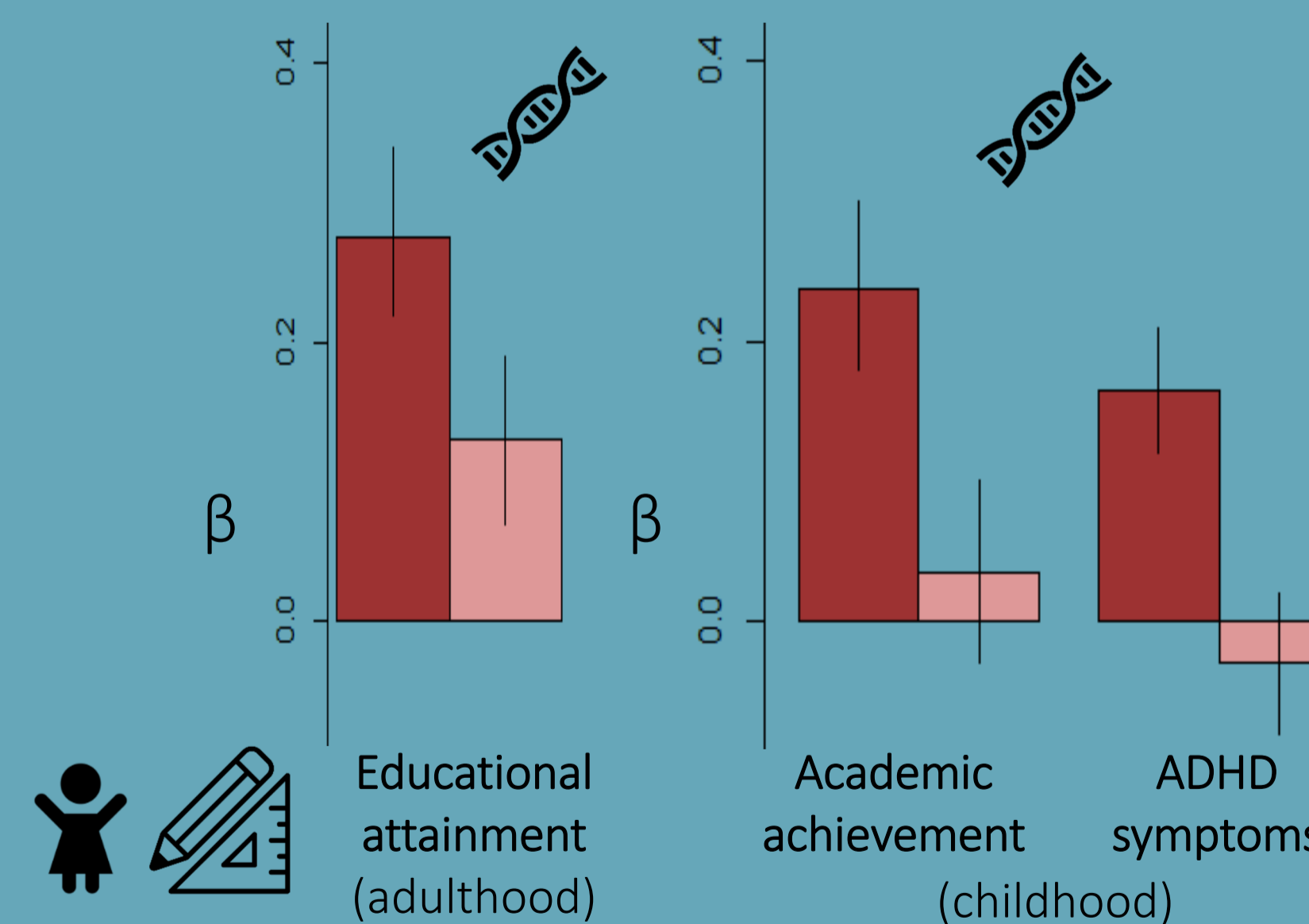
Effects (with 95% CI) of:
1. EA-PGSs on educational attainment in adults
2. EA-PGSs on academic achievement in children
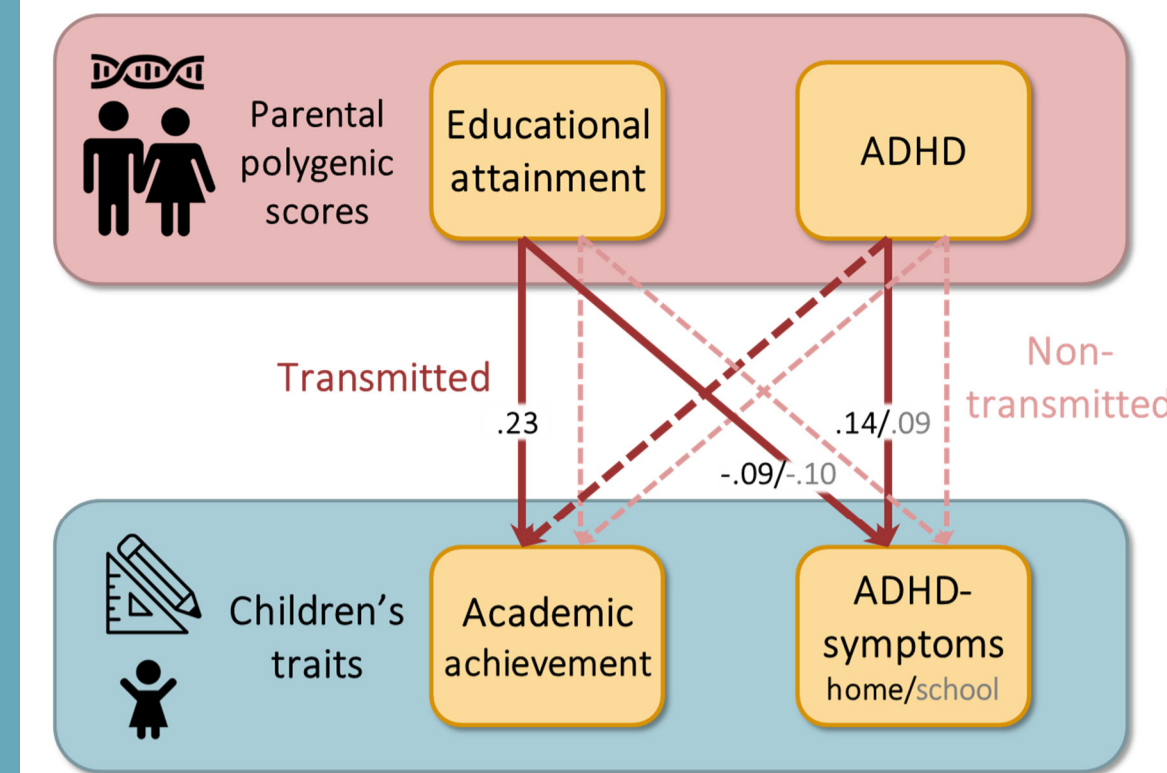3. ADHD-PGSs on ADHD symptoms in children

Table I The estimated effects (with 95% CI) of the transmitted (T) and non-transmitted (NT) polygenic scores for educational attainment (EA) and ADHD on offspring's academic achievement, ADHD symptoms at home and ADHD symptoms at school

	Model 1			Model 2		
	Beta	R^2 (%)	p	Beta	R^2 (%)	p
Academic achievement (N =1,120)						
EA_T	.238 (.18;.30)	5.7	7×10^{-15}			
EA_{NT}	.034 (-.03;.10)	0.1	.284			
$ADHD_T$				-.077 (-.14;-.01)	0.6	.022
$ADHD_{NT}$				-.017 (-.08;.05)	0.0	.610
ADHD symptoms at home (N = 2,518)						
EA_T	-.125 (-.17;-.08)	1.6	4×10^{-8}			
EA_{NT}	-.010 (-.05;.03)	0.0	.669			
$ADHD_T$				.165 (.12;.21)	2.7	1×10^{-13}
$ADHD_{NT}$				-.030 (-.08;.02)	0.1	.190
ADHD symptoms at school (N = 1,969)						
EA_T	-.131 (-.18;-.08)	1.7	1×10^{-7}			
EA_{NT}	-.012 (-.06;.04)	0.0	.637			
$ADHD_T$				.126 (.08;.18)	1.6	3×10^{-7}
$ADHD_{NT}$				.029 (-.02;.08)	0.1	.243
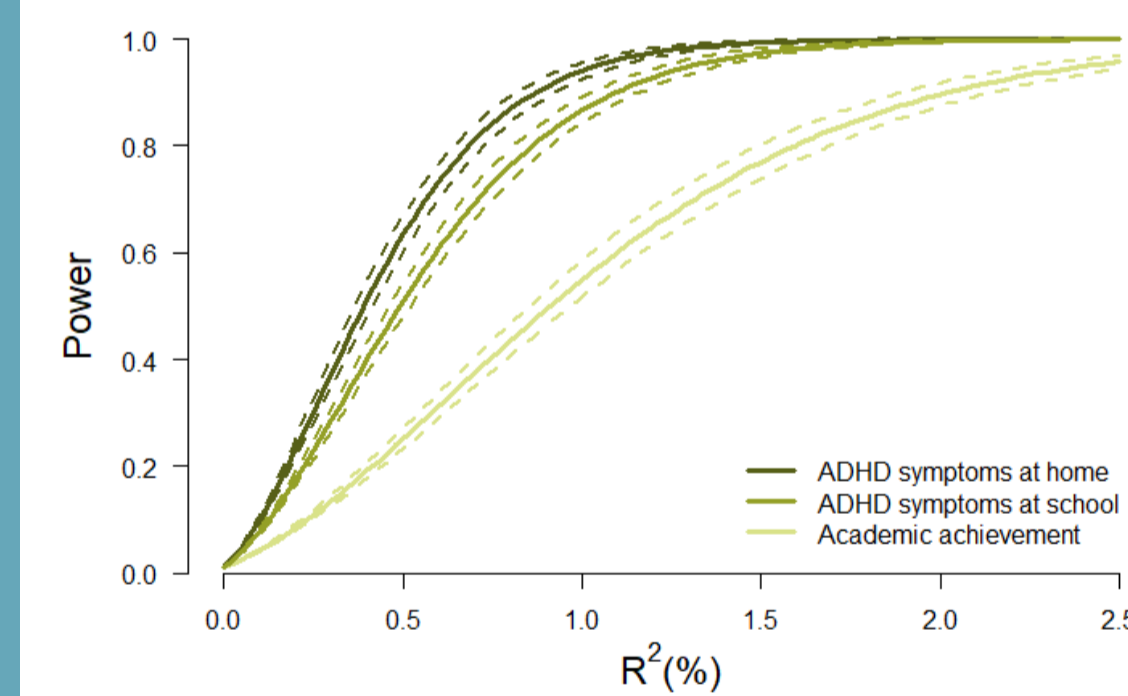
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