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TITLE:

Genetic associations between non-cognitive skills and educational outcomes: The role of parental environment

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ABSTRACT:

Background: Accumulating evidence suggests that parents' genetic variation indirectly influences offspring education via the home environment. No research has assessed contributions of parental genetic variation linked to non-cognitive versus cognitive skills, or compared indirect parental genetic effects across outcome measures, cohorts and analytical methods.

Methods: We define the non-cognitive and cognitive heritable contributions to educational attainment using GWAS-by-subtraction, and construct non-cognitive and cognitive skills polygenic scores in British and Dutch cohorts (UK Biobank, TEDS and NTR). We estimate indirect effects of the polygenic scores on educational outcomes using: siblings (all cohorts; N=47,459), adoptees (UKB; N=6407) and parent-offspring trios (NTR; N=2534). Outcomes include achievement (teacher reports and standardized test scores) at ages 12 and 16, and adult attainment.

Results: Indirect effects of non-cognitive and cognitive skills genetics on offspring education are similar, explaining ~40% of the total effect of each polygenic score on average. Childhood standardised tests show less influence of parents' non-cognitive genetics than other outcomes (e.g. NTR: $\beta=0.01$ for CITO scores, $\beta=0.13$ for adult attainment). The sibling method gives higher estimates of indirect genetic effects than other approaches, particularly for the non-cognitive polygenic score (e.g. UKB: adoption $\beta=0.02$; sibling $\beta=0.16$). This likely reflects population stratification and assortative mating.

Discussion: Heritable non-cognitive and cognitive skills are both involved in how parents create environments that shape offspring education. Estimates of indirect genetic effects are somewhat sensitive to choice of outcome measure, and to patterns of bias affecting particular methods.

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