



TITLE: Genetic analysis of social-class mobility in five longitudinal studies

A research team led by Dan Belsky at Duke University reports that a genetic signature previously discovered in a genome-wide association study of educational attainment is associated with life-course social mobility. As measured by their educational attainment, their occupational careers, and the wealth they accumulated across their lives, children who carried more of the education-linked genetics tended to move up the social ladder compared to their parents. Among pairs of siblings, the sibling who carried more of the education-linked genetics tended to achieve more socioeconomic success as compared to their sibling who carried fewer of the education-linked genetics. In a separate analysis, the team found that education-linked genetics carried by mothers were associated with the attainments of their children over and above the children's own genetics. This finding suggests that the environments parents provide for their children, and not just the genetics they pass on, can influence their children's success. In sum, findings show that education-linked genetics are associated with socioeconomic success because they are associated with upward social mobility, but in part this is because education-linked genetics are related to family environments and parental behaviors that create opportunities for advancement.

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FINDINGS:

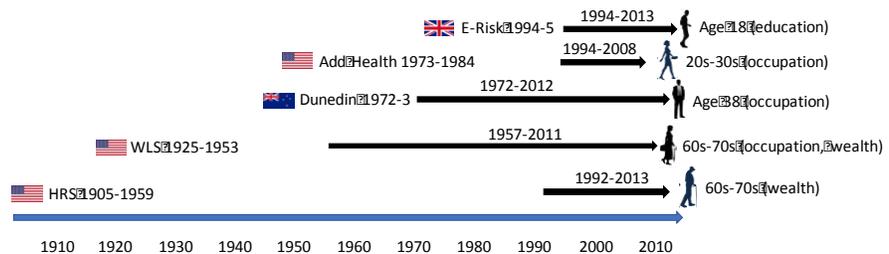
- (1) A genetic measurement called a polygenic score derived from a recent genome-wide association study of educational attainment is associated with success in school, career advancement, and the accumulation of wealth across life. But the polygenic score is also associated with children's family backgrounds. Children with higher polygenic scores tend to come from better-off families, potentially explaining the genetic association with measures of social and economic success.
- (2) In social mobility analysis, we found that children with higher polygenic scores tended to move up the social ladder in terms of education, career success, and wealth accumulation, no matter what their family circumstances were when they were children. Similarly, in analyses that compared siblings in the same family, the sibling with the higher polygenic score tended to achieve more success as compared to their siblings with the lower polygenic score.
- (3) However, taking into account the social class of children's families explained as much as half of genetic associations with life success. In mother-child social-genetic analysis, we found that a mother's polygenic score predicted her child's success over and above the children's own genetics. This finding suggests that part of the reason education-linked genetics are associated with upward social mobility is that these genetics are related to family environments and parental behaviors that create opportunities for children's advancement.

WHY ARE THESE FINDINGS IMPORTANT:

- Findings affirm that genetics discovered in genome-wide association studies of educational attainment are more than correlates of having well-off parents and grandparents. These genetics are associated with patterns of upward social mobility in which children tend to achieve more than their parents in domains of education, career, and wealth. A key implication is that these genetics can provide social scientists with a new tool to study processes of social and economic attainment and mobility.
- Nevertheless, findings highlight that genetic associations with educational attainment are more complicated than initially suspected. Findings suggest that one reason children’s genetics are associated with their future attainments is that these genetics are proxy measures of the family environments children grow up in. This finding, which is consistent with a recent report in Science by Kong and colleagues ([LINK](#)), highlights the importance of understanding family-environment influences on life success and encourages collaborations between geneticists and family researchers to better understand how family environments and behaviors link genetic inheritances with life outcomes.

SUPPORTING DETAILS:

Data: We analyzed data from five longitudinal studies: The E-Risk Longitudinal Study, which has followed 1,000 pairs of twins born in England and Wales in 1994-1995 into young adulthood; The National Longitudinal Study of Adolescent to Adult Health, which has followed 15,000 American secondary school students into adulthood; the Dunedin Longitudinal Study, which has followed 1,000 babies born in 1972-1973 in Dunedin New Zealand into midlife; The Wisconsin Longitudinal Study, which has followed 10,000 1959 high school graduates in Wisconsin and their siblings into later life, and the Health and Retirement Study, which has followed more than 30,000 American older adults since 1992. Our analysis included European-descent study participants with available data on genetics and life attainments.



Study	Social Origins	Social Attainments
E-Risk N=1,860 Born 1994-5 England & Wales	Parental education in 2000, when participants were aged 5 years.	Educational attainment in 2013, when participants were aged 18-19 years
Add Health N=5,526 Born 1973-84 USA	Composite index of parental education, parental occupation, household income, and household receipt of public assistance measured in 1994-5, when participants were in middle school and high school.	Socioeconomic index score (34, 35) based on occupation in 2007-8, when participants were in their late 20s and early 30s.
Dunedin N=831 Born 1972-3 Dunedin, NZ	Socioeconomic index score (69) based on parents’ occupations measured at repeated intervals through the Study member’s 15 th birthday (1987-8) (39).	Socioeconomic index score (38) based on occupations in 2010-12, when participants were aged 38 years.
WLS N=7,111 Born 1925-53 Wisconsin, USA	Composite index of parents’ education, father’s occupation, and household income in 1957, when the focal WLS respondents graduated from high school.	Socioeconomic index score (34) based on occupations 1972-2005, when most participants were in their 30s-60s, and household wealth, measured in 2005-2011, when most participants were in their 60s-70s.
HRS N=8,546 Born 1905-59 USA	Composite index of parental education, father’s occupation, household economic problems, and perceived family socioeconomic status in childhood (70).	Household wealth measured through 2013, when the average Study member was aged 70.

Polygenic Scoring. We took a measurement of the genomes of our Study members using a technique called “polygenic scoring.” Polygenic scores combine information from large numbers of genetic variants all across the genome to measure a continuum of genetic influence. We based the polygenic score on a recent genome-wide association study of educational attainment published by the Social Science Genetic Association Consortium (SSGAC).

Studying Social Mobility. We analyzed social mobility by testing genetic associations with participants’ attainments after statistically controlling for the social class of the families they grew up in. We also conducted sibling-difference analysis that tested if the sibling with the higher polygenic score tended to achieve higher levels of attainment as compared to their sibling with a lower polygenic score.

Mother-Child Analysis. We tested if a mother’s genetics might predict her child’s attainment over and above the child’s own genetics. To conduct this test, we analyzed the association between a mother’s polygenic score and her child’s attainment after statistical control for the child’s polygenic score.

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UNIVERSITIES INVOLVED: Duke University, Durham, NC, USA; Stanford University, CA, USA; University of North Carolina at Chapel Hill, NC, USA; University of Colorado, Boulder, CO, USA; Institute of Psychiatry, Kings College London, UK; Princeton University, NJ, USA; University of Wisconsin, Madison, WI, USA; University of Otago, Dunedin, NZ

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