# Study finds causal connection between genotypes and years of education achieved

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A first-of-its-kind, nationally representative study of siblings supports previously published research on unrelated individuals that links specific genotypes to educational attainment among adults in their mid-20s to early 30s. The research, published today in *AERA Open*, a peer-reviewed journal of the American Educational Research Association, found that, within families, an adolescent with a higher "polygenic score"—which summarizes previously identified genome-wide associations for educational attainment—than her or his sibling tended to go on to complete more years of schooling.

The authors of the study—Benjamin Domingue, Stanford University; Daniel Belsky, Duke University; Jason Boardman, University of Colorado, Boulder; Dalton Conley, New York University; and Kathleen Mullan Harris, University of North Carolina, Chapel Hill—used genome-wide data from 1,594 siblings in the National Longitudinal Study of Adolescent to Adult Health, also known as Add Health.

While the predicted difference in actual educational attainment between siblings was small—roughly one-third of a year of schooling—the study provides new evidence that recently discovered genetic factors actually do cause differences in educational outcomes, according to Domingue.

"By examining siblings, this study was able to control for external social aspects, such as schools, neighborhoods, and level of parental education, to hone in specifically on the role of genes in this complex process," said Domingue. "The study provides strong evidence that genotype can

predict educational attainment within families."

Furthermore, the authors found that the association between genetic predisposition and actual educational attainment was of comparable strength within and between families, indicating that family environments may be magnifying a modest genetic difference between siblings. For example, siblings may seek to differentiate themselves from one another, causing them to form identities that drive them toward more or less academic-related activities. The study found no relationship between a sibling's birth order and his or her polygenic score.

When looking at only African Americans, the genetic effect was found to be smaller but still statistically significant. The authors found comparable results with a polygenic score for body mass index in which the genetic signal was weaker for African-American siblings compared with non-Hispanic white siblings, suggesting that this is a consequence of the methodology used for genome-wide discovery rather than something specific to educational attainment.

In another key finding, the study also documented for the first time that polygenic scores across a broad population sample, going beyond siblings, are associated with social environmental differences.

European Americans with higher polygenic scores tended to live in more socially advantaged neighborhoods and had mothers with higher levels of educational attainment. While African Americans' polygenic scores were not related to the social circumstances of their neighborhoods, they were associated with maternal level of education.

"We show, for the first time, clear evidence for socio-geographic patterning of polygenic scores in the contemporary United States," said Domingue. "Neighborhoods can be important facilitators of, or impediments to, children's social attainments."

The authors emphasize that while there is a causal relationship between polygenic educational scores and educational attainment, among the general population, social factors still play a more important role in shaping outcomes. For instance, having a mother who graduated from college was associated with an additional 1.7 years of schooling.

The authors also warn that the predictive power of the polygenic educational score is too weak to be used for individual clinical interventions, such as, for example, specialized coursework for a child with a low polygenic score.

"These findings are preliminary and warrant further investigation and replication by the research community," said Domingue. "However, the results of this study demonstrate that pioneering efforts such as the Human Genome Project are beginning to bear fruit in terms of genetic insight."

"Eventually, this type of research will help us better understand, across broad groups, the complex relationship between genetics, environments, and traits and behaviors, as well as help us better understand why school or government policies may or may not be generating desired objectives," said Domingue.

**More information:** www.aera.net/Newsroom/RecentAE … d/16036/Default.aspx

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