

Socioeconomic deprivation modifies genetic influence on higher education

April 28 2021, by Linda Koffmar



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A comprehensive study from Uppsala University demonstrates that

socioeconomic deprivation modifies genetic effects on higher education and abstract reasoning. The paper illustrates how genes play a greater role in educational attainment in more socioeconomically deprived regions of the United Kingdom. The study was recently published in the *American Journal of Psychiatry*.

Education is an important factor in an individual's life and strongly linked to economic outcomes and quality of life. The likelihood of completing higher education is partly determined by genetic factors. Common genetic variants have previously been estimated to contribute 11–13% of the variance in whether an individual completes higher education. This heritability is an estimate of how much a trait is influenced by genes.

In the current study, scientists at Uppsala University assessed the heritability of higher [educational attainment](#) and performance on a verbal and numerical reasoning test. Heritability was compared across the socioeconomic spectrum in more than 350,000 participants in the UK Biobank cohort.

The researchers found that common genetic variants contributed 13% of the variance in the least socioeconomically deprived, but almost 26% in the most deprived. "We were surprised to find that the heritability was higher in participants from more socioeconomically deprived regions of the UK. This is the opposite of what previous twin studies have found," says the lead author of the study, Dr. Mathias Rask-Andersen. This type of difference in heritability across the socioeconomic spectrum is likely to represent an interaction between genes and the environment, where [socioeconomic deprivation](#) modifies genetic effects.

Previous studies in the field have mainly been performed in small twin cohorts from the United States. According to Dr. Rask-Andersen, the contrasting results of the current study indicate that national differences

may influence genetic effects. For instance, differences in access to and quality of education across the socioeconomic spectrum may play an important role, as well as welfare support systems and healthcare.

The current study illustrates how the environment determines how an individual's genetic makeup is propagated. "More and more studies demonstrate that environmental factors influence genetic effects," explains Dr. Åsa Johansson, group leader at the Department of Immunology, Genetics and Pathology at Uppsala University. "We have previously seen similar gene-environment interactions for other traits, such as body mass index, and it is likely that interactions also exist for many human diseases."

In the long run, gene-environment interactions offer an additional layer of information on the contribution of genetics to human traits and diseases. Identifying these interactions can potentially lead to more precise forms of interventions, not only for preventing and treating disease, but also for increasing the likelihood of successful educational outcomes.

The results from this study also have implications for notions of equality of outcome and opportunity. "The larger influence of genetic factors in more socioeconomically deprived regions could reflect greater challenges for [higher education](#) in these regions," says Dr. Rask-Andersen. "Someone who is more vulnerable due to [genetic factors](#) would then face even greater challenges in a more socioeconomically deprived region."

How the study was conducted:

UK Biobank is a cross-sectional cohort of almost half a million UK residents aged 40–70 years old who were recruited in 2006–2010. Participants answered extensive questionnaires and were tested for

abstract verbal and numerical reasoning. Educational attainment was determined from the self-reported professional qualifications of each participant. The level of socioeconomic deprivation for each participant was assessed from census data. Each participant was thus assigned a score for socioeconomic deprivation based on their place of residence. Each participant was genotyped and the effects of genetic variants on educational attainment and abstract reasoning were determined by association tests, providing an estimate of the effect of each genetic variant on educational attainment and abstract reasoning. The researchers divided the cohort into five quintiles based on socioeconomic deprivation and performed association tests in each quintile. The heritability in each quintile was then estimated by examining how much the genetic effects contributed to the outcomes. The researchers then compared heritabilities between quintiles.

More information: Mathias Rask-Andersen et al. Modification of Heritability for Educational Attainment and Fluid Intelligence by Socioeconomic Deprivation in the UK Biobank, *American Journal of Psychiatry* (2021). [DOI: 10.1176/appi.ajp.2020.20040462](https://doi.org/10.1176/appi.ajp.2020.20040462)

Provided by Uppsala University

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