SOS2950 – Social Science Genetics

Exam spring 2021 – Assessment guidelines for exam questions

Essay Questions

#1

a) What conclusions on the relative importance on genes, environments (and their interplay), can we draw based on this graph? [Max 600 words] [12 points] **Answer:**

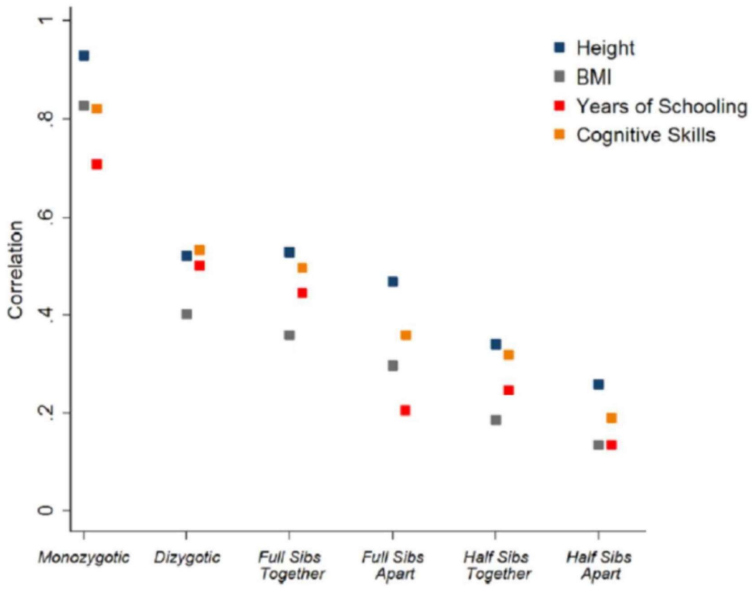
- The graphs shows the similarity of different types of siblings for different outcomes i.e. height, BMI, years of schooling, and cognitive skills. Siblings on this graph differ a) in the degree of relatedness and b) whether they have been raised in the same family context.
- MZ twins are genetically identical, DZ twins share on average 50% of their DNA, full siblings share also on average 50% of their DNA, and half siblings share on average 25% of their DNA.
- The similarity of siblings in these outcomes increases by genetic relatedness: The more genes siblings share, the more alike they are in these outcomes.
- Thus, genetic influences contribute to differences of all four outcomes. The relative importance of genetic influences is more important for individual differences in height, and BMI than for cognitive skills and years of schooling.
- If we want to understand how individual differences in these 4 outcomes come about, genetic influences need to be considered.
- The environment or common upbringing also contributes to the similarity of siblings
- The comparison of full siblings "reared apart" vs "together" and half siblings "reared apart" vs "together" shows that the similarity is higher, when siblings lived in the same household up to the age of 18.
- Not only genetic influences need to be considered to understand the similarity in these outcomes.
- Speaks against any notions of genetic determinism.

b) Define in this context the term heritability and discuss its limitations. In case you are not able to answer part a) you will still get points by answering that question. [Max 500 words]

- Heritability is a statistical concept to describe to what extent differences in individual outcomes are influenced by genetic differences as opposed to environment differences.

Limitations

- Population-parameter: Sources of variation among individuals
- Population- and time-specific
- No natural constant
- High heritability doesn't indicate that,
- something cannot be changed by the environment
- the environment is not important
- Indicates additive genetic influences (no dominance or epistasis)



Note: Two brothers are classified as "reared apart" if they lived in separate households before the age of 18, and "reared together" otherwise. Full brothers share the same biological parents, halfbrothers share one biological parent

#2)

Imagine a representative sample of all residents of Norway. In this sample you find 13 genetic variants that are associated with enjoying Norwegian goat cheese. Explain very briefly why it would be unwise to enthusiastically claiming you have found genes for enjoying Norwegian goat cheese. *Hint:* "Chopsticks-problem" [500 words] [6 points]

- Ancestry differences makes it difficult to know whether the variants are predictive or reflecting of population stratification.

- Genetic differences between various human subpopulations are due to "evolutionary bottlenecks" (processes in our evolutionary history)
- These differences can be thought of a confounding factors in GWAS/PGS analysis.
- Chopstick problem is: if we look for genes for chopsticks in a sample of all kinds of people, we will find them.
- But there are no genetic causal factors behind chopstick use. Just examine chopstick use among kids adopted to Europe (non-chopstick users) from Asia (chopstick users): these kids don't use chopsticks
- Why are there then SNPs assoc. w/chopstick use? Because there are basic genomic differences between europeans and asians. This problem is called "population stratification"
- Ancestry-specific analysis (or within-family analysis) would remedy this. If we study only europeans we remedy this problem. We can also use within-family analysis (comparison of siblings) remedy it