PGT

***Note**: The genetics of intelligence is a very controversial topic. Not only is intelligence likely to reflect much more than just genetics, the mere definition of 'intelligence' is controversial. Perhaps for these very reasons, this is a useful example for illustrating the complexities of using genetic information.*

Imagine that, in the next 10-15 years, scientists discover a series of variants linked to intelligence, as cataloged by multiple GWAS of intelligence. (These studies assessed intelligence using various neurocognitive tests, e.g. as in Savage et al. (2018))

A PRS-based test is developed that can be performed on embryos before they are implanted in the uterus, and a company begins to sell the test to doctors. The company that sells the test claims children who are selected for intelligence could go on to better colleges, better jobs, etc.

You want to give your children every advantage possible. You moved to be closer to the best school in your neighborhood and you spend as much time as possible helping with homework. Your child knows how important it is to work hard at school.

You used IVF for your first child because of fertility issues and expect you will use it again. You are now debating whether to use this new PGT to select an embryo.

Discussion questions:

- Applying one of the four bioethics principles that has been assigned to your group, what decision will you take?
- Is it ethical for companies to offer such tests?
- What additional considerations do you have?
- Would your decision differ if it is for a complex disease e.g. coronary artery disease?

Adapted from pgEd (Reproductive Genetic Testing: Technology, Access, and Decision Making)

Genetic Engineering

At present, there is no cure for hypertrophic cardiomyopathy (HCM), a condition characterized by a thickening of the heart muscle. Drugs and surgery are available to relieve symptoms and prevent sudden cardiac death in people at high risk.

However, recent research on animal models and human embryos *in vitro* have reported successful correction of mutations on one of the genes that causes HCM. HCM is an autosomal dominant transmitted disorder that results from a mutation in one of nine sarcomere proteins' genetic makeup but can also occur due to *de novo* mutations. Multigene panels can diagnose HCM by looking at several genes associated with HCM. Genetic testing can be used to diagnose HCM. There are other screening tests (such as electrocardiogram, ECG). The American College of Cardiology (ACC)/American Heart Association (AHA) consensus guidelines recommend 12 years as the starting age for family screening of first-degree relatives of people with HCM.

HCM often goes undiagnosed because many people with the disease have few, if any, symptoms. However, in a small number of people with HCM, the thickened heart muscle can cause shortness of breath, resulting in sudden death.

You are an elected official. You need to make an informed recommendation whether this particular germline genetic engineering should be approved, and if so, the path to approval.

Discussion questions:

1. Should this germline genetic engineering be approved or not? Why
2. What additional information would you like to have in order to make your recommendation?
3. If you support approval, what path to approval do you see feasible?
4. Do your considerations differ in the previous case study (on PGT)? How so and why?

Adapted from pgEd (Reproductive Genetic Testing: Technology, Access, and Decision Making)