

Want a tall, smart child? How IVF tests are selling a dream

The "best" child is not the one with the highest genetic score; it is one born into a loving family with access to good nutrition, education and health-care. These environmental factors have far more influence on how a child develops than tiny variations in DNA.

BY ALEX POLYAKOV

Prospective parents are being marketed genetic tests that claim to predict which IVF embryo will grow into the tallest, smartest or healthiest child. But these tests cannot deliver what they promise. The benefits are likely minimal, while the risks to patients, offspring and society are real. Parents deserve accurate information, not marketing hype, when making profound decisions about their future children.

Which tests are we talking about?

Prospective parents can already have their IVF embryos tested for inherited conditions. But these tests often relate to a single gene, such as for cystic fibrosis. However, this latest type of testing tries to predict complex traits influenced by thousands of genes operating together. The testing generates "polygenic risk scores" for individual embryos.

This is said to be an embryo's theoretical risk of developing conditions, such as heart disease or Alzheimer's, or having certain traits, such as high IQ or above-average height. Parents can then use these scores to choose which embryo or embryos to transfer. Multiple companies in the United States do so. One, Nucleus Genomics, has papered New York with posters to market these tests with the tagline "Have your best baby".

The company offers to screen embryos for up to 2,000 traits. These include eye colour, IQ, baldness, and conditions people usually develop later in life, such as Alzheimer's and heart disease.

What the research actually shows

Researchers cannot examine the benefits for predicting late-onset diseases at all since the outcomes will not be known for decades. And mathematical modelling shows vanishingly small benefits, perhaps a few IQ points and one to three cen-

ISSUES AND CONCERNS

Experts recommend preimplantation genetic testing to avoid serious genetic conditions. But polygenic risk scores aim to predict the future risk of developing a condition or trait. They are not a diagnosis. So, using polygenic risk scores for embryo selection is inconsistent with the guidelines, and operate in a regulatory grey zone. That does not stop prospective parents sending a sample, or genetic information derived from their sample, overseas for analysis. There are also profound ethical concerns. This technology echoes eugenics movements that ended in forced sterilisation and Nazi atrocities. Selecting embryos for traits such as intelligence or skin colour risks entrenching discrimination and deepening social inequalities.

timetres in height.

To some people, 3cm in height might sound a lot. But we cannot be certain how relevant this and other predicted benefits are, for a number of reasons. Polygenic risk scores have been derived from studying people currently in their 50s and 60s who lived in vastly different environments. They grew up without smartphones, current levels of processed foods, air pollution and microplastic exposure. Their education, healthcare and lifestyle factors were fundamentally different.

This matters because traits and diseases result from lifelong interactions between genes and the environment. The same genetic variants that contributed to diabe-

tes in the 60s might behave differently today. So we cannot assume genetic patterns from past populations will predict outcomes in radically transformed environments in the future.

Lifestyle and environmental factors cannot be captured by genetic testing. So polygenic risk scores examine only one side of a complex equation, ignoring the environmental side, which may be equally or more important.

Consider IQ. Early childhood education, nutrition, parental engagement and socioeconomic factors have an enormous impact on cognitive development. Choosing an embryo with a marginally "better" genetic score for IQ, while ignoring these proven influences, is like predicting a plant's height from its seed alone, without considering soil, sunlight or water.

There is also pleiotropy, where one gene affects multiple traits. For example, selecting for higher educational achievement might inadvertently increase your risk of choosing an embryo with a higher risk of bipolar disorder.

Cruel irony

Parents may find themselves paralysed by the weight of these choices, second-guessing their decisions for years, or choosing not to transfer any embryos.

There is a cruel irony: couples who undergo IVF solely for polygenic risk score testing, rather than for fertility issues, reduce their chances of having a healthy baby. That is because IVF carries risks, such as an increased risk of high blood pressure in pregnancy and preterm delivery. The very process of obtaining a biopsy from an embryo to analyse its DNA may also affect pregnancy outcomes. So prospective parents may be trading proven risks for unproven benefits.

