

## Large study identifies numerous genes associated with risk tolerance and risky behaviors

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An international group of scientists has identified 124 genetic variants associated with a person's willingness to take risks, as reported in a study



published today in Nature Genetics.

The scientists highlight that no variant on its own meaningfully affects a particular person's risk <u>tolerance</u> or penchant for making risky decisions, and non-<u>genetic factors</u> matter more for risk tolerance than genetic factors. Yet, taken together, the genetic variants identified in the study shed light on some of the biological mechanisms that influence a person's willingness to take risks.

The study shows evidence of shared genetic influences across both an overall measure of risk tolerance and many specific risky behaviors. It is one of the largest genetics studies to date, and is based on the genetic information from over one million individuals with European ancestries—much larger than any previous study on the genetics of risk tolerance.

"Genetic variants that are associated with overall risk tolerance—a measure based on self-reports about individuals' tendencies to take risks in general—tend to also be associated with more speeding, drinking, tobacco and cannabis consumption, and with riskier investments and sexual behavior," said Jonathan Beauchamp, corresponding author and assistant professor of economics at the University of Toronto.

"We also found shared genetic influences on overall risk tolerance and several personality traits and neuropsychiatric traits—including ADHD, bipolar disorder, and schizophrenia."

The effects of each of the 124 genetic variants on an individual basis are all very small, but their combined impact can be significant.

"The most important variant explains only 0.02 percent of the variation in overall risk tolerance across individuals," said Beauchamp. "However, the variants' effects can be combined to account for greater variation in



risk tolerance."

The authors created a 'polygenic score' that captures the combined effects of 1 million genetic variants and statistically accounts for approximately 1.6% of the variation in general risk tolerance across individuals.

"I expect it to be useful in social science studies," said Beauchamp. "For instance, the score can be used to study how genetic factors interact with environmental variables to affect risk tolerance and risky behaviors."

The authors add, however, that the score cannot meaningfully predict a particular person's risk tolerance or risk taking behavior.

The 124 genetic variants are located in 99 separate regions of the genome. The study found no evidence to support previously reported associations between risk tolerance and certain genes (such as genes related to the neurochemicals dopamine or serotonin—which are involved in the processing of rewards and mood regulation). Instead, the authors' results suggest that the neurochemicals glutamate and GABA contribute to variation in risk tolerance across individuals. Both are important regulators of brain activity in humans and animals: glutamate is the most abundant neurotransmitter in the body and boosts communication between neurons, whereas GABA inhibits it.

"Our results point to the role of specific brain regions—notably the prefrontal cortex, basal ganglia, and midbrain—that have previously been identified in neuroscientific studies on decision-making," Beauchamp said. "They conform with the expectation that variation in risk tolerance is influenced by thousands, if not millions, of genetic variants."

The data for this study were from the UK Biobank, the personal



genomics company 23andMe, and 10 other, smaller genetic datasets.

**More information:** et al, Genome-wide association analyses of risk tolerance and risky behaviors in over 1 million individuals identify hundreds of loci and shared genetic influences, *Nature Genetics* (2019). DOI: 10.1038/s41588-018-0309-3

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