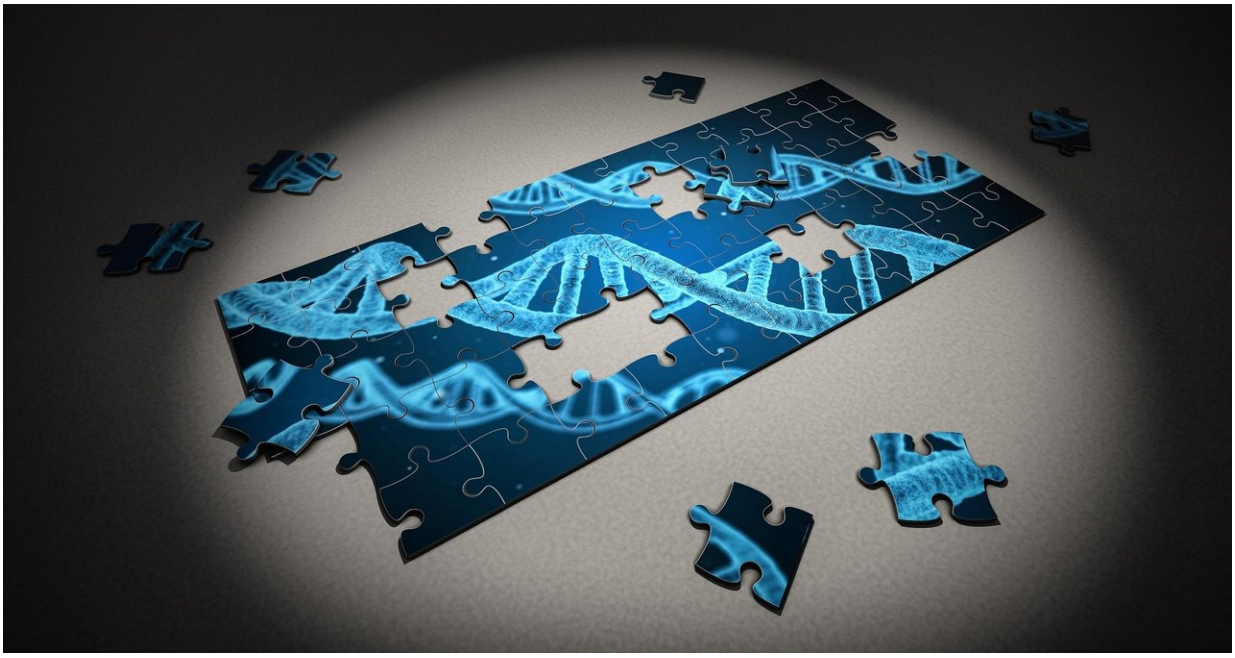
Receiving genetic information can change risk

December 11 2018, by Amy Adams



Credit: CC0 Public Domain

Millions of people in the United States alone have submitted their DNA for analysis and received information that not only predicts their risk for disease but, it turns out, in some cases might also have influenced that risk, according to a recent study by researchers at Stanford University.

The team, led by Alia Crum, assistant professor of psychology, found

that when people were told of a genetic propensity for either obesity or lower exercise capacity, it altered the way their bodies responded either to a meal or to exercise. The work was published Dec. 10 in *Nature Human Behavior*.

"Receiving genetic information doesn't just make you more informed," Crum said. "What this study shows is that it can also have a physiological impact on your body in a way that actually changes your overall risk profile."

Crum and the study's lead author, graduate student Bradley Turnwald, said that the results don't suggest that DNA testing is bad or good, just that when delivering information, genetic counselors or personalized genetic testing companies need to be aware that the mere knowledge of the test result could influence a person's risk.

A brief deceit

To carry out the research, the group first took DNA samples from people who were told they were participating in a study about the relationship between DNA and diet. Later, the participants returned and 116 of them carried out an exercise test, while 107 of them ate a meal. After the meal, the researchers measured levels of molecules in the blood that indicate hunger or fullness.

Unbeknownst to the participants, Crum and Turnwald had tested the participants for one of two genes – one that has been associated with obesity and one associated with exercise capacity. During that first round of tests, the researchers could see small differences in either exercise capacity or satisfaction after the meal, depending on which version of the gene the people carried. People with the protective version of the exercise gene did have slightly better exercise capacity, for example.

A week later, when participants returned for their second test, they were given a genetic result that might or might not have been true. Some of those with genes that protect them from obesity or gave them higher exercise capacity were told they had a higher risk version of the gene, and vice versa.

People were also given reading material that helped explain the effects of having a particular form of the two genes. In the obesity group, participants read research summaries and lay research articles suggesting that one version of the gene made them produce less of a hormone that relays an "I'm full" signal to the brain. In the exercise group, participants learned that people with a particular gene variant wouldn't perform as well during exercise.

After being told their randomly generated genetic results, the people then carried out exactly the same test as on their first visit – either eating a meal or running on a treadmill.

What the researchers found is that the information alone changed how people performed.

Those who were told they had a version of the gene that made them less prone to obesity actually performed better after the second meal. They produced two and a half times more of the fullness hormone, even though the meal was identical to the one they'd eaten the week before.

"It was really a much stronger and faster physiological satiety signal, and this mapped on to how much more full participants said that they felt," Turnwald said.

People who were told they were genetically prone to obesity saw little or no change in how full they felt or in their hormone levels.

By contrast, people told they had a gene that made them respond poorly to exercise then went on to do much worse on a challenging treadmill test. Their lung capacity was reduced, they were less efficient at removing carbon dioxide, and they quit the treadmill test sooner. All indications were that the people were in worse shape than they were before learning of their fictitious genetic risk, in accordance with what participants were told about their genetic risk for exercise capacity.

People told they had the protective gene variant performed about the same as in the first test.

"It's interesting that in the exercise study we saw a negative effect for those who were told they had the high-risk version, but in the eating study we saw a physiological improvement in people who were told they had the protective gene," Turnwald said. "What was consistent in both studies was that those informed that they had the high-risk gene always had a worse outcome than those informed that they had the protective gene, even though we essentially drew out of a hat which information people received."

Those differences between groups were in some cases even stronger than the real differences they saw as a result of people's actual genetic results. All this underscores the fact that the act of receiving genetic information and the resulting mindset can have as much of an impact as the genes themselves in some instances, according to Crum.

"The take-home message here is that the mindset that you put people in when you deliver genetic risk information is not irrelevant," she said. "The mindset of being genetically at risk or protected can alter how we feel, what we do and – as this study shows – how our bodies respond."

Keep the benefits, eliminate the risk

Immediately after the testing, Crum and Turnwald told participants about the research goals and revealed their actual genetic risk if the participant still desired.

"We took a lot of steps to conduct the research ethically and ensure participants' safety," Turnwald said. "For example, we chose genes related to obesity and exercise capacity because we knew that information would be meaningful but less emotionally charged than genes related to diseases like cancer, and participants only held a potentially false belief about their genetic risk for one hour while under our supervision before being fully debriefed."

Next, the researchers are interested in exploring whether there are ways to explain genetic risk that eliminate the effects they saw in this study.

"How can you deliver genetic information in a way that has the beneficial effects in terms of motivating people to change their behavior but that doesn't provoke a negative effect on physiology, emotions and motivation? That's where I think a lot of really good work can be done," Crum said.

More information: Bradley P. Turnwald et al. Learning one's genetic risk changes physiology independent of actual genetic risk, *Nature Human Behaviour* (2018). DOI: 10.1038/s41562-018-0483-4

Provided by Stanford University