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## SPECIAL REPORT

## **Genetic testing for everyone**

Private companies are starting to test customers' DNA for gene variants linked to an increased risk of conditions such as obesity or Alzheimer's disease. **Helen Pearson** looks at whether knowledge really is power when it comes to disease avoidance.

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erry Drotos was adopted at birth. She knows nothing of her biological family's medical history and so cannot use it to gauge her or her daughter's future health. When she was offered the chance to have her genetic information analysed, she jumped at it.

Drotos was one of the first to try the genetic testing service offered by Navigenics, based

in Redwood, California. After the company analysed her DNA for gene variations linked to 19 conditions, she was relieved to hear that her susceptibility to Alzheimer's disease is no higher than average. But she was surprised to learn that her risks of obesity and type 2 diabetes are 2–3% higher than average for her age group. Drotos is slim and exercises regularly, so there was little

more she could do to lower those risks. "It really does show that if I wasn't already taking care of myself, I probably would be overweight or diabetic," she says, although geneticists would probably disagree with her assessment.

Direct-to-consumer genetic testing is a rapidly growing market — the past year has seen the launch of companies, such as Navigenics and 23 and Me in California and DeCODEme in Iceland, that offer DNA screening for a range of common genetic variants linked to disease. The testing outfits have created a buzz in the business and research communities as well as in the

wider public: Google has invested in two of them and Navigenics briefly opened a store in New York's hip SoHo district.

The idea is that test-takers will be alerted to risks and so take preventive action where possible. But psychosocial scientists who study how people respond to risk information say there is scant evidence that people are affected deeply by

genetic test results, or that such tests spur much change in behaviour.

"In public these genetic-testing companies have made a big splash, and it's an intriguing idea that you can peel back your genome and



Will genetic testing add anything when it's already known that obesity is a health risk?

reveal something about your future," says Robert Green, who studies Alzheimer's disease at Boston University in Massachusetts. "But if that idea disappoints," he adds, "some of the lustre will fade."

The service provided by these companies

## Breaking the news

A common perception is that hearing the results of a genetic test confirming an increased risk of, for example, breast cancer, causes shock, distress and lasting psychological scars. So genetic information is treated as medical dynamite. This is knowledge that must be communicated gently, the conventional wisdom goes, preferably by a trained genetic counsellor.

No one denies that genetic test results can be life-altering for some individuals. But research by Theresa Marteau, a health psychologist at King's College London, and others has shown that most people are remarkably resilient in the face of traumatic genetic test results. They typically report feeling anxious or depressed around the time of testing, but these effects dwindle within a few months. Studies by Aad Tibben, a psychologist and psychotherapist at Leiden University Medical Centre in the Netherlands, and his colleagues showed that people who took predictive tests for Huntington's disease mostly recovered from the shock. Many actually felt more in control after testing because they could make arrangements for care, or even for euthanasia.

With so much uncertainty about how people deal with genetic risk,

is genetic counselling necessary or helpful for people undergoing the less definitive tests for an increased propensity for heart conditions or diabetes? "I'm convinced it's necessary," says Tibben. But he and others in the field acknowledge that there is little in the way of controlled trials to support their belief.

"We can't say empirically that people are better off after seeing a genetic counsellor," says Barbara Biesecker of the US National Human Genome Research Institute in Bethesda, Maryland. Even if counselling does seem beneficial, as some studies suggest, it is not known

why. Did the counsellor help the patient understand complicated risks, or just provide some faceto-face contact and empathy in a confusing medical world?

Studies are under way to answer some of these questions. California-based Navigenics is co-sponsoring a large, fivegroup trial with researchers at the Mayo Clinic in Rochester, Minnesota. This will examine how participants react psychologically and behaviourally to medical risk information based on different sources, including family history and genetic testing, and presented to them with or without counselling.



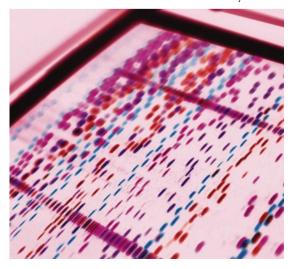
differs from most existing genetic testing, which has been a niche medical service limited to those with a family history of breast or colon cancers or other hereditary diseases. A positive genetic test for these conditions means that the person is at very high risk or even, in the case of the neurodegenerative Huntington's disease, that the condition is inevitable.

## **Changing behaviour**

Very little is known about how people will respond to the new genetic tests, which reveal a small increased susceptibility to complex conditions involving many genetic and environmental factors. For example, Drotos was told that her lifetime risk of obesity was 34% compared with an average of 32% for someone of her sex. In this sense the tests are more akin to finding out about high blood pressure or excess weight, factors that are linked to heart disease and diabetes but that do not say for sure whether any individual will get them. "It would be silly to think these small risks will have a major psychological impact," says Barbara Biesecker, a genetic counsellor at the US National Human Genome Research Institute in Bethesda, Maryland.

One of the very few clinical trials to examine how recipients handle this type of low-risk information is being led by Green.

Half of the several hundred participants were assigned to receive genetic testing for a variant of the apoliprotein E (ApoE) gene. People with two copies of this variant have an increased risk of Alzheimer's of up to 15 times the average for the general population. Green says that "people do very well with this information", with any mild initial distress (see 'Breaking the news') being resolved within about six months after being told. His team has also found that those with the risk variant were more likely to



Genetic tests can only predict one risk factor for common conditions such as heart disease and diabetes.

make changes to their diet or medication even ន though there is no proven way of preventing Alzheimer's.

Many researchers question whether genetic information will be any better than existing health warnings or family medical history at prompting people to change their behaviour. Most people with a generous waist measurement know they're at risk of obesity-related conditions and what they ought to do about it — genetic information may not help them.

"The question is whether genetic information is a big enough motivator," says Susanne Haga, who studies health policy and genomics at Duke University in Durham, North Carolina. "It's naive to think people are going to have a complete turnaround in their lifestyle." Indeed, one concern is that testing could backfire: people who find out they are at low risk for a condition could use this as an excuse not to adopt healthy behaviour. "It could go the opposite way as well," Haga says.

Elissa Levin, director of genetic counselling for Navigenics, says that genetic test information may help people to refine their health advice in combination with a family history or other risk factors — perhaps spurring them to have earlier screening for colon cancer. "There is a lot to say about the utility of this information apart from 'exercise and eat well," she says. "We'd be pretty surprised if there was no benefit." Although Drotos was already doing all she could to ward off obesity, she says her test results prompted her daughter to shed some weight.

With so little hard evidence that genetic testing is beneficial, many experts question whether there is much value at all for people who buy the new tests. "The most likely outcome would be disillusionment that they paid a lot of money and got very little," Biesecker says. But more

> is at stake for healthcare policy-makers, who have to decide whether paying for \(\vec{\pi}\) genetic testing or counselling, now or in the future, will give a return in improved public health. "I don't think healthcare has faced something quite so challenging as this," says David Veneestra, who studies health policy at the University of Washington in Seattle.

Veneestra believes that the value of genetic information may go up as the cost of testing and sequencing drops, and if, as he predicts, trials begin to show that genetic testing can cause small changes in behaviour, refinements in drug dosing or other benefits. Even if only 5% of people change their lifestyle for the better after testing, that could be worth the cost over a population. "If you start to add those up, your initial investment would start to look worthwhile," he says.