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I Had My DNA Picture Taken, With Varying Results

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I like to plan ahead; that much I knew about myself before I plunged into exploring my genetic code. I'm a healthy 28-year-old woman, but some nasty diseases run in my family: coronary heart disease, rheumatoid arthritis, Alzheimer's and breast cancer.

So I decided to read the tea leaves of my DNA. I reasoned that it was worth learning painful information if it might help me avert future illness.

Like others, I turned to genetic testing, but I wondered if I could trust the nascent field to give me reliable results. In recent years, a handful of studies have found substantial variations in the risks for common diseases predicted by direct-to-consumer companies.

I set out to test the tests: Could three of them agree on me?

The answers were eye-opening — and I received them just as one of the companies, 23andMe, received a stern warning from the Food and Drug Administration over concerns about the accuracy of its product. At a time when the future of such companies hangs in the balance, their ability to deliver standardized results remains dubious, with far-reaching implications for consumers.

My experiment ran into hurdles from the start. After I ordered 23andMe's saliva test kit, which for $99 promised a report on more than 240 health conditions and traits, it turned out that I could not legally send it in; the New York State Health Department forbids any labs that lack a state permit to accept specimens from a health-related test. Luckily, my in-laws mailed it from their home in New Jersey.

Then I learned that the other two companies I planned to approach were no longer offering genetic testing. Additional research led me to two more: Genetic Testing Laboratories and Pathway Genomics. G.T.L. charged $285 for a report on 25 disease risks, and required a professional sample collector to draw blood; Pathway charged $399 for a report on 24

disease risks. (In 2010, Pathway planned to sell its saliva test kit at Walgreens, but abandoned the idea after the F.D.A. challenged the sales. Now Pathway requires a doctor to order a kit on a patient's behalf.)

After my tests had been sent, I braced myself for the revelations about my DNA. It took about two months to receive all the results, and when I did, the discrepancies were striking.

23andMe said my most elevated risks — about double the average for women of European ethnicity — were for psoriasis and rheumatoid arthritis, with my lifetime odds of getting the diseases at 20.2 percent and 8.2 percent. But according to Genetic Testing Laboratories, my *lowest* risks were for — you guessed it — psoriasis (2 percent) and rheumatoid arthritis (2.6 percent).

For coronary heart disease, 23andMe and G.T.L. agreed that I had a close-to-average risk, at 26 to 29 percent, but Pathway listed my odds as "above average."

In the case of Type 2 diabetes, inconsistencies on a semantic level masked similarities in the numbers. G.T.L. said my risk was "medium" at 10.3 percent, but 23andMe said my risk was "decreased" at 15.7 percent. In fact, both companies had calculated my odds to be roughly three-quarters of the average, but they used slightly different averages — and very different words — to interpret the numbers. In isolation, the first would have left me worried; the second, relieved.

Medical ethicists and other experts have a different kind of worry about results like these: a lack of industry standards for weighing risk factors and defining terminology.

"The 'risk is in the eye of the beholder' standard is not going to work," said Arthur L. Caplan, director of medical ethics at the New York University Langone Medical Center. "We need to get some kind of agreement on what is high risk, medium risk and low risk."

Several other problems may account for my discrepancies. The genetic testing that these three companies offer is premised on reading segments of DNA called SNPs (pronounced snips), for single nucleotide polymorphisms. But these segments, which have been linked to diseases in research studies, vary among people.

Scientists have identified about 10 million SNPs within our three billion nucleotides. But an entire genome sequencing — looking at all three billion nucleotides — would cost around $3,000; the tests I took examined fewer than a million SNPs.

“Imagine if you took a book and you only looked at the first letter of every other page,” said Dr. Robert Klitzman, a bioethicist and professor of clinical psychiatry at Columbia. (I am a graduate student there in his Master of Bioethics program.) “You’re missing 99.9 percent of the letters that make the genome. The information is going to be limited.”

Companies choose which SNPs to read. By comparing the technical reports provided with my results, I found that my tests sometimes relied on different SNPs to assess the same condition, like coronary heart disease. Each test studied four to 15 markers, with almost zero overlap, though two tests reached similar conclusions about my odds.

In the case of rheumatoid arthritis, though, the tests examined the same five markers, plus a few others, and delivered contradictory interpretations.

J. Craig Venter, chief executive of his namesake institute and of Synthetic Genomics, was a pioneer in sequencing the human genome in 2000. Though he issued recommendations to genetic testing companies four years ago to help them improve their predictions, he remains skeptical of their clinical value.

“Your results are not the least bit surprising,” he told me. “Anything short of sequencing is going to be short on accuracy — and even then, there’s almost no comprehensive data sets to compare to.”

Another source of variation was in the estimates of average risks. For example, 23andMe listed the typical odds of obesity at 59 percent, while G.T.L. listed them at 30 percent.

But the major issue, experts say, is that the causes of most common diseases remain unknown. Genes account for just 5 to 20 percent of the whole picture.

“Even if they are accurately looking at 5 percent of the attributable risk, they’ve ignored the vast majority of the other risk factors — the dark matter for genetics — because we as a scientific community haven’t yet identified those risk factors,” said Dr. Wendy Chung, an associate professor of pediatrics and medicine and the director of clinical genetics at Columbia.

Environmental factors play a role. A study published in 2007 demonstrated this link: After pregnant mice were exposed to various levels of a chemical, their genetically identical offspring were born obese and yellow or small and brown.

There are only 23 diseases that start in adulthood, can be treated, and for which highly

predictive tests exist. All are rare, with hereditary breast cancer the most common. “A small percentage of people who get tested will get useful information,” Dr. Klitzman said. “But for most people, the results are not clinically useful, and they may be misleading or confusing.”

23andMe declined to comment for this article. Jim Bentley, the chief operating officer of General Genetics Corporation, which owns G.T.L., said test results should be interpreted with professional guidance: “Because of the complexity of genetic testing results and other factors that have a role in determining the long-term potential health risks a person may face, such as environmental conditions and personal health habits, G.G.C. requests its customers provide information that would allow us to send the results of our predisposition test to a physician.”

The chief medical officer of Pathway, Dr. Michael Nova, said: “Pathway Genomics is accredited by the College of American Pathologists, and accredited in accordance with the U.S. Health and Human Services’ Clinical Laboratory Improvement Amendments of 1988. As such, we are held to a higher standard for report accuracy than our unaccredited competitors.”

To be sure, my tests did provide some beneficial information. They all agreed that I lack markers associated with an increased risk of breast cancer and Alzheimer’s.

That said, they were testing for only a small fraction of the genetic risks for these diseases, not for rare genetic variants that confer much of the risk. I could still develop those diseases, of course, but I don’t have reason to pursue aggressive screenings as I age.

In June, the Supreme Court prohibited the patenting of genes that exist in nature. But the ban did not apply to DNA created in the laboratory, leaving the door open to additional patents in the field. That will encourage the industry to gather big bio-banks of people’s genomes — the more, the better.

In the wake of the F.D.A. warning, 23andMe has stopped providing data on health risks, and a class-action lawsuit alleges that the company’s results are “meaningless.” The company’s supporters have launched a petition to protest the warning.

Until and unless the predictive science improves, experts advise consumers to take most of their results with a grain of salt.

The tests “may be interesting as a kind of entertainment,” Dr. Caplan said, “but do not take them seriously yet in driving your health care or your lifestyle.”

He added: “If you want to spend money wisely to protect your health and you have a few hundred dollars, buy a scale, stand on it, and act accordingly.”