Opinion

From Fraternities to DNA: The Challenge Genetic Prediction Poses to Insurance Markets

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LAST YEAR MY SON WAS APPLYING FOR CAR INSURANCE FOR THE first time. He fell into the highest risk group, demographically speaking—a nineteen year old male, newly licensed driver—so the premiums ended up costing him all his summer earnings. But I was intrigued as I watched him search. When shopping online, the various big company websites asked him a series of seemingly invasive questions: What was his major of study? What was his GPA? Did he belong to a fraternity? Obviously, the data scientists at Geico had figured out that the answers to all of these questions had incremental value in predicting accidents and, by extension, claims. This information allowed the company to risk adjust and price policies accordingly. (I'm pretty sure the rate goes up if you are in a frat.)

Under the rules of the Affordable Care Act, health insurance companies are forbidden from either denying coverage or altering the price of insurance premiums based on preexisting conditions—or fraternity membership, for that matter. However, health insurance is only one form of coverage that relates to health. There is, of course, long-term care insurance and life insurance. And to the extent that it relates to accidents, car insurance has a health component. And the major players in all of these markets have sought to risk adjust with a vengeance. John Hancock, for example, now requires all new policyholders to wear a fitness tracking device and share the data it generates with the company.¹

A new form of data will soon enter this world of AI-informed insurance pricing, and it behooves us to think about how we may or may not regulate the use of those data—that is, genetic information about individuals. Up until recently, genetic information was not very useful. Scientists (myself included) had been looking for big effects of specific genetic loci. Though there are a few of these lurking in our DNA—such

as *APOE-4* for Alzheimer's disease risk—one of the important discoveries over the past decade has been the phenomenon of polygenicity. Polygenicity refers to the fact that almost any outcome you can think of—from height to IQ to schizophrenia to diabetes—is influenced by thousands of places along the genome, most with an almost miniscule effect.

But, as it turned out, by adding these small effects together each person can be given a number that we call a polygenic score (or PGS), which predicts with some power a particular outcome, say, for example, body mass index (BMI). There are PGSs for schizophrenia and depression, and for diabetes and cardiovascular disease. There's even a PGS that predicts schooling success. Those with scores in the bottom quintile for the education PGS enjoy a mere 12% chance of graduating college with a four-year degree while those in the top quintile have almost a five-fold increased likelihood of getting a bachelor's degree (58%). Given that education is one of the best predictors of health and health behaviors, it should come as no surprise that this educational attainment PGS is associated with myriad health outcomes as well.

Currently, the best performing PGS is for height, followed by education and BMI.^{2,3} As study sample sizes grow larger and larger and as scholars switch from the genotyping chips presently used to whole genome sequencing that captures more genetic markers, these scores will continue to improve. Granted, even at their best, PGSs will still predict with much error since health and behavioral outcomes are also influenced by environmental forces. That means that they will predict poorly for any given *individual*. But when insurers have thousands of clients, knowing this information will no doubt save them millions of dollars if they use PGSs to risk adjust. This leaves the customer who was unlucky in the genetic lottery and thus faces exorbitant premiums in a hard place. And, after all, isn't insurance supposed to be about risk sharing? That's the reason why health insurance is mandatory, of course, and why car insurance is as well.

Is there something that makes genetic information different than fraternity membership? Public opinion suggests yes: Because genes are not within our control like our GPA or health behaviors are, they are seen by many as the ultimate preexisting condition and something that should be held outside the domain of market pressures. Indeed, in 2008, President George W. Bush signed the Genetic Information Non-Discrimination Act (or GINA). This law prevents the use of genetic

information by health insurance companies and by employers. However, it says nothing about the other markets discussed above. An enticing policy solution might be to amend the law to extend protections to related domains. However, this apparently simple fix has now been made a lot more complicated by a parallel development that has occurred in tandem with the improving science of genetic prediction: the rise of consumer genomics.

Today at least 15 million Americans have access to their own genome-wide data thanks to the fact that the cost of genotyping has been falling faster than Moore's law in micro-computing (which states that every 18 months the price of memory will drop by half). That number is surely to grow by leaps and bounds as companies like 23andMe and Ancestry aggressively market directly to consumers. Most customers sign up to learn about their genetic heritage, meet distant relatives online, and to find out about specific genotypes like the so-called sprinter's gene (*ACTN3*).

That said, the companies allow customers to download their raw data and other sites have cropped up where these million-plus DNA markers can be uploaded (such as dnaland.com) and polygenic scores can be calculated. Before long, I will be able to generate a predicted probability for my chances of developing dementia or heart disease, as well as a score for the genetic component to my longevity. And then, I can act on this information by insuring myself against my newly discovered risks. Indeed, a study back in 2009 found that individuals who found out that they had a higher genetic propensity for Alzheimer's disease said they would be more likely to buy long-term care insurance.⁴

This is a problem, of course, since such adverse selection can generate a death spiral in insurance markets. The more high-risk individuals that sign up, the higher the premiums will go, driving away low-risk individuals and further raising prices until only the worst off will buy insurance and the market collapses.

Since we cannot ban individuals from calculating their own genetic risk scores, the solution to this looming transformation of insurance markets lies not in banning companies from accessing the information; rather, the solution is to create the same three-legged stool of mandated insurance combined with no price discrimination and with subsidies for those who cannot afford it—at least in the case of long-term care insurance. As an aging society, and one that will increasingly become a geno-society—that is, a society awash in and reactive to genetic

information—we cannot afford to wait to reform this market. Otherwise, it won't make a difference whether or not my son belongs to a fraternity because there may not even be a marketplace for him to buy any insurance before too long.

References

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