Patient, quantify thyself

When was the last time you met atechnologyCEO who knew how to deliver a baby? And, for that matter, when was the last time you met adoctorwho knew how to code?

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In highereducation, as in life, healthcare and computerscienceare two separate and deeply immersive tracks. Perhaps this explains, in part, why the promise of technology to disrupt health care has not yet been realized.

Even as breakthroughs in DNA research, such as genome sequencing, allow a physician to peer into a patient's biology at the deepest level, and even as consumer devices track our health in real time, the raw data gathered lacks the requisite interpretation -- the " processor," to use code-speak -- that's needed to make it actionable.

Data alone does not a healthy human make. And medical wisdom and medical data do not run together as a program. At least not yet.

When they do -- andI believethat it's now just a matter of time -- we'll see a revolution in health care. As a physician, I see astronomical opportunities for entrepreneurs and VCs in this space. They need to start seeing them, too.

As a for-instance, imagine a time when we can monitor our health trajectory, spotting -- and reversing -- our body's decline long before disease expresses itself as symptoms. We will have truly moved from the " disease-care" model of today to true health care.

Some of us are doing this already with our patients, capturing genetic, epigenetic and hormonal data, together with bloodwork results and other biomarkers over time.

The idea is not just to quantify the individual in a single snapshot, but to *interpret* this data. It can then become a dataset over time that can deliver actionable guidance to change the health trajectory of each individual. At this point, however, that kind of thinking has not yet been baked into any kind of algorithm. If you liken this scenario to the need to build a bridge between health care and technology: We're still drawing up the plans.

Very early, and interestingly, intersections of technology and health care, however, *are* in motion and will become more important as multilayered data interpretation becomes de rigueur. It's intersections like these that should be of interest to venture capitalists and consumers alike.

Making the connections

Google, to throw in one big name here, is attempting to create such connections: Consider its new , which it worked on withHarvardMedical School and the Mayo Clinic to improve Google search results, based on symptoms typed into the search bar. Or, note the search giant's contact lenses, which will monitor blood glucose levels for diabetics.

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Then there's , an early pioneer of the modern internet. An astrophysicist and computer science professor, Smarr was among the first advocates to stockpile his personal medical data.

Smarr actually has tracked his own biomarkers for years, and saw inflammatory markers in his health readings long before he was diagnosed with Crohn's disease. Yet his physicians were quick to dismiss the data until the symptoms became evident. Little surprise there: Doctors are trained to limit testing, be discerning and avoid " fishing trips" when symptoms are not immediately evident.

But things are starting to change: A number of visionary scientists, academics and clinicians are leading the " self quantifier" revolution, using novel digital health tools to track biomarkers over time, with the goal to detect, predict and reverse disease at the cellular level.

a professor and chairman of the personalized medicine and genetics department at Stanford University's School of Medicine, detected his own Type 2diabetesearly -- data his conventional doctor had dismissed due to Snyder's thin physique. The Stanford researcher picked up on things by sequencing his genome, then at short intervals.

He caught the disease early, eliminated sugar, added running to his biking routine -- and reversed the course of the condition.

In fact, Snyder wears several devices to monitor his various biorhythms: One such wearable that showed a protein change allowed him to diagnose Lyme disease accurately before its symptoms appeared.

Given such stories and this overall the use of devices and testing offers great promise. But there are barriers. One is that in a healthcare economy where insurers are looking for cost savings -- and are loathe to pay for new testing

-- these data-centric, personalized approaches may seem to be nonstarters until they are proven to reduce cost.

And, because, on average, insurers don't keep the same customers over the long term, they are not likely to be fans of methods that will improve individuals' health decades out.

Despite this issue, many consumers are already taking ownership of their health. Consider the widespread use of new digital tools and devices, absent insurance coverage. Fitbit recently saw its stock rise due to strong margins and demand for its wristband health trackers.

" I think [wearables] can improve our health care tremendously," Dr. Snyder recently told me, showing off a wrist bedecked with multiple health-tracker armbands. We were standing on the sidelines of an Understand Your Genome event we and were co-hosting in New York earlier this summer. " Minimally, you will catch things early," Snyder said. " And we can make wearables do so much more than they presently do."

Consider what happened with a study Snyder led. It had been set up to track biomarkers of a group of individuals. One study subject, a man wearing a device to measure his blood pressure, found an arrhythmia he didn't know that he had. The discovery may have saved his life.

" I don't know if [wearables] will lower costs; in principle they should," Snyder said. " In instances where people are at risk for heartfailure, it will savemoney."

More gaps between the medical sector and technology

Still, other gaps between the medical sector and technology persist and may take longer to bridge. For instance, the average doctor is not taught in medical school to read data from this long-view quantification perspective. Were you to bring your FitBit charts to your next physical, the likelihood is strong that your doctor would be stymied.

Doctors are not taught how to apply such longitudinal data sets to improve health.

In theory, digital health devices should allow doctors to review information about an individual's baseline healthy state and observe changes over time, in order to better identify irregularities and trends. This would require a complete shift in mindset, though, from the current model, where most doctors capture a limited snapshot of a patient's health picture and compare it to population averages only when that patient is already sick.

" In a doctor's office today, you really do get 15 seconds of measurements: bam, bam, bam," says Snyder, indicating that this snapshot is inadequate. " Devices let you measure individuals continuously."

But there is hope for a change in mainstream medicine. Even as insurance companies keep an eye on costs, they are testing the value of this trend; for instance, where it pays its own employees a cash bonus if they get enough sleep, as verified by a FitBit.

In fact, Aetna's program may point to a model of the future, when insurance companies will pay discounts for verification of health behaviors or will incentivize measurement and tracking for better health outcomes.

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Overall, the real proof of concept will come when we arrive at the point where an individual's data will feed into systems that produce interpretation and direction -- information that physicians and patients alike can use to truly improve long-term health outcomes.