



Scenario

A world of difference

This is a world in which the successful application of big data and artificial intelligence leads to rapid advances in personalized medicine and prevention, diagnosis and treatment informed by genetic information. Not everyone has access to the fruits of these innovations. Disparities between and within nations perpetuate a “haves” versus “have nots” dynamic.

In 2040, all babies except those born in remote rural regions get their DNA sequenced, as do people at airports seeking to enter affluent countries. Distributed mini-testing labs make widespread gene sequencing fast and convenient for most.

Ensuring the health of the population is seen as a way for rich nations to maintain their economic power and influence. It's also a way to restrain the growth of health care costs, which are an increasing strain on public budgets in nations with aging populations. As a result, governments seek to exclude newcomers, and even

visitors, whose DNA could make them susceptible to illnesses that have the potential to spread to citizens. The problem of noncitizens hoping to enter wealthy countries becomes acute in the 2030s, as climate refugees from the Pacific islands and low-lying nations like Bangladesh increase.

People share all of their health genetic data with large providers, drug development firms and tech companies active in the health care industry—it is a requirement to obtain care. This includes not only genetic data and electronic health records but also information about daily life, including eating and exercise habits, gathered by the complex array of wearable and embedded sensors most people use.

Large Western tech companies and their counterparts in China, which previously took the lead in exploiting data for targeted advertising and selling, apply their knowledge about working with data to assume a major role in health care. Big tech harvests health information from developing countries and rural/remote areas in advanced countries and works with pharmaceutical companies to test new therapies in those places first. Residents in these areas are happy to volunteer, since it is often their only chance to access advanced therapies.

Health insurance premiums are adjusted based on genetic characteristics and data on people's habits. Since the affluent have more money to buy better food and more leisure to exercise, ironically, their health insurance premiums are lower. People of modest means eat fewer healthy foods, exercise less and are more susceptible to a range of chronic diseases, so their insurance premiums are higher.

Access to health care is determined not by the country in which people live but rather by disparities in access tied to regional differentials within countries. People living near Shanghai or San Francisco, for example, are able to get the same advanced treatments, with the richest taking advantage of cutting-edge breakthroughs that border on science fiction.

Some countries are initially more aggressive in development of genetic therapies and attract wealthy patients from around the world, not only for genetic therapies but also for genetic enhancements. The countries that move first are able to capture valuable intellectual property and also generate revenues by treating wealthy patients who want to be early adopters of the latest advances. These funds can then pay for the next round of research. This dynamic eventually draws other advanced countries, which had initially proceeded more slowly due to ethical concerns, into a global genetic therapy "arms race."

Media reports about the "6 billion dollar man" (a name that riffs on the title of a 1970s American television series about an astronaut whose body was enhanced with bionic implants that cost 6 million dollars) tell of a Silicon Valley titan who, in his quest for immortality, spends huge sums on research and testing of genetic enhancements designed exclusively for him.

Genetic tinkering, albeit on a less elaborate scale, becomes the norm for the most affluent. As a result, in some countries the life expectancy gap between the top 1 percent and the bottom 80 percent comes to exceed 50 years.

In the 2030s, the first babies are born whose DNA includes sequences taken from other people. Some parents choose DNA sequences taken from the reconstructed genomes of great geniuses from prior eras, like Albert Einstein and Leonardo da Vinci. Leather goods grown in labs from skin cells of prominent 21st century celebrities become a hot fashion item.

In parallel, gene harvesting—which acquires DNA snippets associated with desirable traits, like immunities, reproductive health and even height and beauty—becomes a major industry. The concept of the genetic lottery takes on a new meaning when the best genetic material can be obtained for the right price.

In areas outside of major cities, such as Appalachia or Western China, only the most affluent have access to advanced treatments. High-priced therapies are out of reach for those of modest means, and 1 billion people in urban slums cannot access even basic care. Those in poorer regions who struggle to access care are at the same time more likely to suffer disproportionately from the

negative health effects of climate change. Responses to this situation are varied.

In the late 2020s, insurers in the U.S. begin to sell plans that offer lower premiums but rely on medical tourism. Patients can file claims only if they have the most advanced treatments in foreign countries, where they are provided at lower cost. In 2030, a California bank offers the first mortgage to fund the cost of medical treatment. Over time, medical loans become prevalent and are treated much as educational loans are handled in the U.S. today, with borrowers unable to declare bankruptcy to escape repayment. Wall Street is able to bundle these medical loans and sell securities comprising tranches of patients with similar medical conditions. Patients who obtain well-established treatments for chronic diseases are bundled to create AAA-rated bonds; those who receive experimental treatments for rare diseases are bundled into bonds that are riskier but offer higher returns. The prices of these securities are volatile, shifting quickly as new discoveries arise and new knowledge emerges about the likely outcomes of therapies.

With so many people unable to access the latest medical advances, growing resentment spurs massive demonstrations across the world. Some developing countries invalidate patents or enforce licensing to reduce the costs of new therapies. Rich countries respond by introducing complex security measures to prevent unauthorized copying of new therapies. Counterfeiting of traditional pharmaceuticals and newer biologics becomes increasingly common and small-scale. Local labs begin to synthesize medicines in a do-it-yourself (DIY) way, compromising quality and safety in order to provide low-cost therapies to patients in need. These labs are unable to share data and best practices effectively and also cannot absorb the costs associated with standard quality processes and safety testing. As a result, such DIY efforts often cause harm to patients by not providing effective treatments or exposing them to toxic substances.

Broad public support for government investment in medical innovation wanes, since it is seen to benefit the few and not the many. Regulations on therapies are loosened, since the richest are able to vet new treatments themselves and jet around the world to wherever the research related to their condition is most advanced. Their social media posts, which tell of the advanced treatments they receive, only make more apparent the gulf between the care the wealthiest receive and that which other members of society can access.

Given these dynamics, the affluent maintain strong trust in medicine and the health care system, as might be expected, since they are the beneficiaries of remarkable new treatments. When the less affluent can obtain top-line treatment, they still trust that it is sound. Trust in the health care system as a whole, however, understandably erodes overall for those who lack access since they are often subject to predatory practices such as highly risky clinical trials or unproven and unsafe DIY therapeutic approaches. ●



Implications

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In this future, the focus of medical innovation is on finding breakthrough treatments that can extend or enhance life, even if they come at a great cost. Researchers seek to push the envelope, with the knowledge that wealthy patients will pay what is required.

Regulators find their role circumscribed as compared with the past. Large corporations dominate innovation processes, effectively privatizing what were formerly government-based approaches for approving new medical practices. Regulators end up merely rubber stamping advances sought by rich patients and big companies. Regulators find themselves strapped for resources, since their government funding bases are squeezed. This is a world where the rich are able to reduce their tax burden and the broader public is less willing to support government activities that they don't see as benefiting them directly. Regulators can, however, keep in place safety and efficacy requirements for the legacy treatments upon which the majority of people rely.

Similarly, standards-setting bodies have a more circumscribed role. They continue to protect the public by ensuring standards for mature remedies remain in place. For cutting-edge treatments, however, a "Wild West" mentality prevails, with countries and companies seeking to become first movers in the realms where they are active so their proprietary approach can become the de facto industry standard.

In this future, individuals' trust in the health care system is shaped by their place on the economic ladder. The affluent, who receive cutting-edge treatments that extend their lifespans and enhance their mental and physical capabilities, understandably have great trust in the health care system. Those at the lower end of the economic scale see the benefits of these treatments and trust they are safe and efficacious. That is, they trust in medicine itself, but they do not trust a health care system in which they cannot access its full benefits. ●

In sum, this is a future of impressive medical advances, mostly made by large private companies and mostly for the benefit of the wealthy. It's a world tailored to advancing the health of the wealthiest one percent. Less-affluent members of society respect the value of these medical advances; they know they work well, sometimes almost miraculously so, and wish they could receive them for themselves. But most people must make do with the legacy treatment options they are able to afford. This stirs resentment and mistrust of the health care system overall. Regulators and standards setters play a smaller part in overseeing breakthrough advances than in the past. They do, however, play a salutary role in ensuring the safety and efficacy of mature treatments upon which most people rely.
