



Scenario

# Dangerous uncertainty

**This is a world where problems with big data and artificial intelligence lead to devastating health care failures. Unequal distribution of access means only the rich receive the most advanced treatments while people of modest means turn to therapies informed by traditional folkways. The efficacy and safety of science-based medicine is called into question.**

The high hopes that applying big data and AI would unlock new therapies are not fulfilled—far from it. Instead, a series of major missteps fosters deep, widespread disillusionment.

In one high-profile instance from 2022, algorithms mis-prescribe drugs to a group of African American patients at a large hospital in Los Angeles, leading to hundreds of deaths. Investigations reveal that errors were

caused by data-gathering flaws and algorithmic biases, since minorities and less-powerful groups have been systematically underrepresented in clinical research studies.

A group of startups based in San Francisco seeks to develop a range of IT-enabled therapies, such as diagnostic AI, sensor/app bundles and telemedicine bots. With their venture capital investors pushing them to reach scale quickly, these companies skirt regulatory requirements (much as Uber did in the ride-sharing domain) and field products before their safety and efficacy have been fully proved. This leads to a series of high-profile accidents and ensuing skepticism.

Many other disasters follow. Dozens of patient deaths are tied to software bugs in a cutting-edge smart sensor/insulin pump device. An elective CRISPR-based vision enhancement procedure developed in Japan, which promised to let people perceive colors outside the visible spectrum, instead causes blindness in numerous patients within five years. Sympathy for the victims is tempered because they chose to undergo an elective procedure that

was not medically necessary, but the incident undermines confidence in therapies based on genetic modification.

The backlash against AI grows stronger when investigative journalists report that, at some major hospitals in the U.S., algorithms were tuned to maximize revenues and profits rather than patient outcomes. Disillusionment deepens further when hackers from enemy countries seek to corrupt medical algorithms in a set of concerted cyberattacks. Several of these attacks are focused on top-ranked medical centers in North America and Europe, which were aggressive early adopters of data- and AI-enabled medicine.

Other scandals are tied to medical advances used for nefarious social or political purposes. Some authoritarian governments institute mandatory DNA sampling, so as to be able to identify and arrest protesters with technology that can project how people's faces look based on their genetic makeup. By finding traces of DNA at the site and matching them against the national genetic database, authoritarian rulers can detect who was present at a demonstration even in the absence of video images.

These developments lead to a near halt by the mid-2020s in large-scale application of big data and AI in health care. The slowdown is exacerbated by lack of interoperability and failure to achieve broadly agreed-upon standards. Medical researchers in Western countries reexamine the sampling practices they have long used in early stage drug development and clinical trials, with the goal of eradicating bias. This leads to a chaotic period in which long-established practices are reassessed and progress is slowed even more.

In parallel, policymakers deliberate about what new rules should be established to protect the privacy of patient data and govern the use of AI in health care. The process gets bogged down in dysfunctional bickering between groups hoping to foster continued medical progress and populists who don't take the time to understand the technical issues and seek to gain political advantage from prior missteps.

The inability of people of modest means to access the best medical care leads to widely publicized cases in which gullible patients are victimized by medical counterfeiters. Counterfeiting medicine reaches the scale seen in the 2010s in the luxury goods markets. Regulators and standards-setting bodies increasingly devote their attention to detecting and removing substandard and counterfeit medicines from circulation and debunking ineffective/unsafe alternative therapies. As a result, they are able to devote less time and resources to evaluating new science-based treatments, further slowing advancement.

Most people come to mistrust the health care system and the scientific ethos on which it is based. Increasing tribalism in society leads some people to rely less on credentialed experts and more on peers. Among such groups, there is a turn away from science-based medicine and growing usage of remedies with ties to traditional cultures, which are promoted by adherents

on social media. For example, more people come to rely on acupuncture and Chinese herbal remedies as their sole treatment regimen, not simply as a complement to Western medicine. There is also growing use of food- and nutrition-based therapies for patients who cannot afford conventional medical treatments.

In some cases, this has salutary effects: A return to traditional ways of eating, like the Mediterranean diet or consumption of the oily fish eaten by the Inuit people of the Arctic, improves health outcomes for some. Certain people, who possess the right genetic characteristics or are naturally resistant to disease, do well in a survival-of-the-fittest environment. These lucky survivors become convinced of the correctness of their ways, and their folk-based approaches to medicine become seen as increasingly legitimate within certain subpopulations. In some instances, charismatic individuals and their eccentric health recommendations, amplified by the megaphone of social media, achieve cult leader status among their true-believing followers.

Yet, unfortunately, reliance on folk medicine leads to troubling outcomes for many. Some of a health cult's followers may not have the right genetic endowment for the prescribed regimen and thus experience negative consequences. Since there is no science-based evidence to turn to, it becomes impossible to predict who is likely to benefit and who is not. Anti-vaxxer beliefs become even more widespread, leading to localized instances where illnesses formerly thought to have been eradicated reoccur.

Sales of alternative medicines come to exceed those of patented/approved medicines in the U.S., yet life expectancy declines. Widespread mistrust of science among the public means there is no support for objective studies to find the causes of this decline, which only reinforces the vicious cycle.

The educated professional classes also lose trust in the health care system but for different reasons. Daunted by high-profile failures centered in leading research hospitals, they turn against care informed by data and AI. They guard their own medical records closely, and those with the means turn to a new kind of primary care physician, who offers highly personalized care, informed by science, but is hesitant about recommending any measures that are not well established and rigorously vetted. Some of these physicians work with trusted, locally based community biotech labs, which are able to synthesize drugs that are known to be sound.

This world is one where trust in the health care system has become fragmented. For the few who can afford the most advanced treatments, high-tech medicine offers big benefits. Much of the educated middle class comes to feel suspicious about the medical establishment and trust only a small coterie of locally based health care providers. The less affluent rely increasingly on traditional folk medicine and food-based cures, recommended by people they trust from their local communities or those they engage with on social media. ●



## Implications

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**In this fragmented, fractious world, the rich support continued incremental medical breakthroughs but at a slower pace than had been expected. The middle class finds its own trusted local providers. Those with less education and lower incomes are vulnerable. Regulators and standards setters fill a void by seeking to eradicate substandard and counterfeit drugs and providing sound recommendations about which alternative remedies are safe and effective.**

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Innovation slows in this future, due to widely publicized failures of IT-based medicine and genetic modification. This creates a strong backlash. Any health care initiatives that have associations with Silicon Valley or established biotech companies come to be seen in a highly negative light. Ironically, there is a great deal of innovation in areas for which the benefit to patients is at best uncertain. Proponents of folk remedies and food-based cures use social media creatively to gain adherents. Counterfeiters proliferate, preying on unsuspecting patients who cannot afford to pay the full price and seek to purchase medicines on the cheap.

In the face of a dizzying array of substandard and counterfeit chemically and biologically based drugs and a broad range of newly launched “alternative” therapies, regulators initially get swamped. They focus their resources on preventing damage that could be caused by potentially dangerous substances, but this leaves less bandwidth for vetting new science-based therapies. To protect public health, governments need to provide additional resources to help regulators staunch the flow of substandard and counterfeit medicines and launch educational campaigns to notify the public about the potential dangers.

Efforts to create standards for the use of big data and AI flounder, which serves to slow advances in IT-based and genetically based medicine. Standards setting for drugs becomes more challenging as well, in the face of ingenious and adaptive counterfeiting operations. Standards-setting organizations recognize that they need to play a role in evaluating the folk remedies and food-based cures that are all the rage in some communities and on social media. By evaluating which of these approaches are effective—and for whom—and then communicating that information through trusted sources, standards setters reduce the uptake of regimens that don’t work or have the potential to cause harm.

In this future, the foundations of trust become fragmented. The very affluent—the global elite and those in their close professional circles—benefit from leading-edge treatments and continue to trust the science-based medical establishment. Members of the middle classes, however, grow skeptical of high-tech medicine after they witness high-profile failures of IT-enabled gene-based therapies at prestigious medical centers. They come to rely mostly on people they know for their care. This creates demand for locally based physicians and community bio-labs that develop drugs to serve this set of patients. The least affluent use folk medicines and food-based therapies based on recommendations from members of their face-to-face and virtual communities. ●