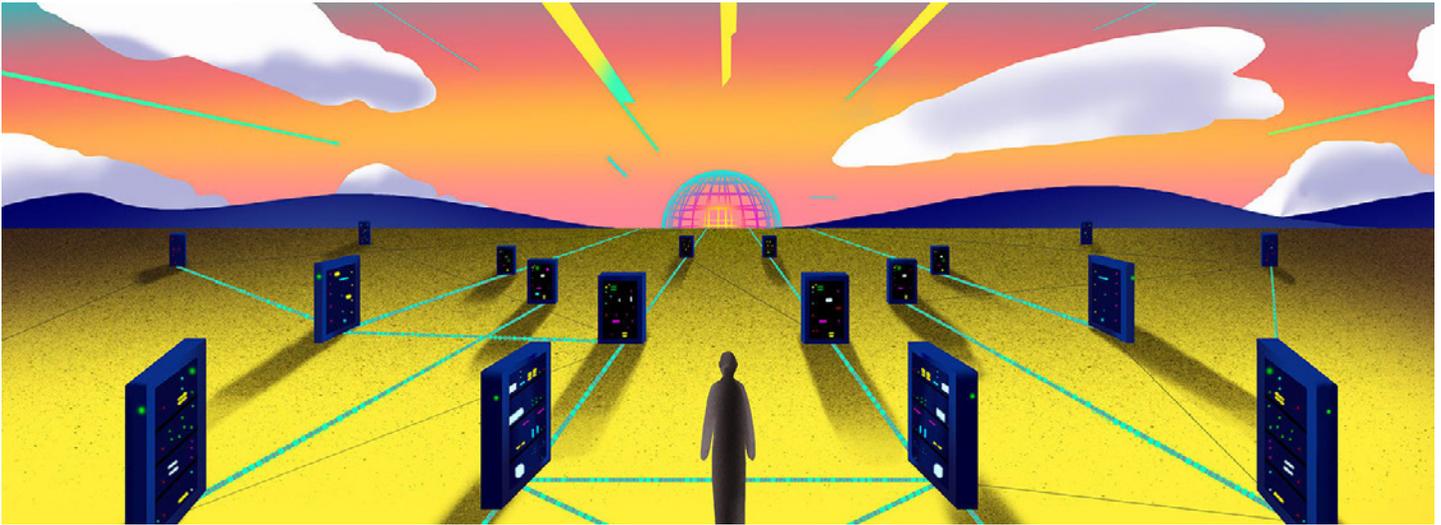# An A.I. Revolution

## WHY A.I IS THE GAME CHANGER HEALTH CARE NEEDS

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The data generated in the health care industry increases by 48 percent every year. The amount produced in 2020 alone could exceed 2.3 zettabytes, or 2.3 trillion gigabytes. That's the amount of data it would take to watch 262 million years straight of HD movies.

This tsunami of data, along with industry inefficiencies, make health care ripe for digital innovation. **A.I. and machine learning** in particular hold the potential to reduce costs while improving the health of millions of people.

"Health care is enormously complex and has a disproportionate impact on us as a society and as individuals," says Dr. Keith Dunleavy, a medical doctor and the chief executive officer of Inovalon (NASDAQ: INOV). "There are few other areas where the amount of information relevant for the assessment of a person's life is as deep and potentially impactful as it is in health care."

At the same time, even as the volume and complexity of data are increasing, the time that medical professionals have to spend with patients and to assess their data is decreasing. "This is just one reason why health care is an area where A.I. is tremendously helpful," Dr. Dunleavy says.

That's because A.I. can instantly sort through millions of variables and provide recommendations to doctors, insurers, pharmacies and just about anyone else involved in a patient's care. And that could be the game-changer the health care industry needs to improve care while lowering costs.

## Myriad Insights From Exponential Data

With so much data available, A.I.-driven diagnostics can work faster with greater accuracy, in many cases, than health professionals working alone, according to Karim R. Lakhani, a Harvard business professor and a co-author of "Competing in the Age of AI."

"We know that humans are flawed," Lakhani says. "If you see a doctor on Friday afternoon, it's going to be a very different outcome than seeing somebody Monday morning. Machines are always performing at a level for which you want them to perform."

And machines will only get better, says Marco Iansiti, also an author of "Competing in the Age of AI" and a Harvard business professor.

"As the algorithms get better and the data continues to flow in, you will see an increase in individual use cases enabled through A.I. in diagnostics," he says. According to PwC, these include:

- Earlier detection of diseases through innovations like faster, more accurate translations of mammograms and other diagnostic imaging.

- Data-based guidance from providers to help patients stay healthy, thanks to continuous monitoring of vital signs and other parameters through apps and wearable devices.

- Better management of chronic illnesses through A.I.-powered monitoring, and predicting and detecting potentially dangerous episodes.

- Better coordination of treatment plans among clinicians, pharmacies, patients and others, with the help of A.I. platforms that gather data.

- Streamlined drug research and discovery through A.I. and laboratory robotics for faster testing of a broader array of compounds.

- A.I.-powered training for clinicians in the form of realistic simulations and natural-language interactions.

A.I. tools are increasingly helping doctors make the best use of their time with patients, according to Dr. Dunleavy.

"Healthcare providers have limited time and resources," he says. "Knowing which patients need to be seen is an important step. Helping

to summarize and prioritize often long lists of issues to be evaluated once the physician is with the patient is another. These are examples of capabilities that are arguably best informed by A.I."

The health care industry, however, presents unique challenges to realizing those opportunities.

## Solving the Health Care Data Challenge

One of the biggest challenges to making effective use of A.I. in health care is that data "remains uncollected, siloed or otherwise inaccessible," according to McKinsey & Company.

Modern software tools that bring together A.I. and data to boost patient outcomes can overcome this challenge by leveraging data sets that span the range of health care services.

"A.I. helps first by helping to aggregate, sort through, normalize, clean and translate the many different sources of information that pertain to a patient. This then sets the stage for applying evermore advanced layers of A.I. to higher-quality sets of pertinent data," Dr. Dunleavy says.

Organizations that benefit from the higher-quality, more comprehensive data brought together by A.I. tools include:

- Payers, by helping them design and inform very large-scale quality measurement and improvement programs, which achieve better outcomes at lower costs.

- Providers, by helping them identify patients most in need of evaluation or those experiencing worsening conditions that might otherwise go unnoticed, supporting more rapid and accurate diagnoses and avoiding potentially unnecessary tests, delays or treatments.

- Life sciences organizations, by speeding the process of device or drug discovery, aggregating and sorting through clinical trial data more quickly, identifying unique subsets of patients who may benefit from a treatment, and predicting outcomes and recommending adjustments in dosing or care in patients with multiple or complex conditions.

- Pharmacies, by helping spot potential adverse effects from taking different drugs or combinations of drugs, predicting who will take medications as directed and determining how some patients may benefit from altered approaches to their medication plans to achieve ideal outcomes.

These benefits are being achieved through an important combination of capabilities. "In order for A.I. to bring significant value and impact to health care, multiple combined capabilities are needed," Dr. Dunleavy says.

Broad connectivity into the myriad data sources that make up the health care ecosystem result in large-scale, real-world data sets that create well-trained A.I. algorithms. The ability to apply these algorithms to specific patients on demand and in real time is a key component.

One of the challenges in sorting through health care data is dealing with a high volume of nonstructured data, as well as the large amounts of structured data like billing claims and laboratory results.

"Nonstructured data is very common in health care," Dr. Dunleavy says. It includes the physician's notes on patients, radiologists describing their findings in X-rays, surgeons describing their procedures, health care providers summarizing a patient's hospital stay, and notes by other members of the healthcare profession and, increasingly, by patients. In short, it's all the human input describing symptoms, conditions, outcomes, background and more that goes into a patient's file.

"It's different from, arguably, any other industry or body of practice," Dr. Dunleavy says. "Natural language processing has been around for some time and successfully applied in industries like financial services and customer support. But health care gives it a tough challenge."

Apply the same technology to interpreting a patient's course of treatment, including medications, reactions, surgical procedures, etc., and things quickly get complex.

"It can be rather challenging for a computer to digest a complex medical record entry and spit out the one or two definitive diagnoses that brought the patient acutely to the doctor," Dr. Dunleavy says. "As the computer attempts to 'read' through the details, perhaps five medical conditions are mentioned in the patient's family history, another five current symptoms, another four previous symptoms the patient isn't sure are related, 15 different rare disease considerations might be raised by the physician — each with varying degrees of denoted suspicion — three things the patient raised as concerns from talking to friends or searching the internet, and, perhaps, the patient's previous medical conditions are discussed within the medical record as well. That can all add up to quite a complex web of medical jargon."

"Boiling this down to valuable, structured data to add to the patient's already structured data is no trivial task," he added.

That's where A.I. proves essential, not only to "read" but also to correctly interpret unstructured data, based on a deeper body of knowledge than might be available in a clinical note. Billions of medical events held by Inovalon help to train advanced A.I. in interpreting this data quickly. That, in turn, provides invaluable help to providers, pharmacists and payers in drawing appropriate conclusions.

And that's only one area in which A.I. has the potential to transform health care. Other capabilities provided by A.I.-powered tools at Inovalon include:

- Predicting adverse events and outcomes such as falls in nursing homes, identifying the worsening of chronic disease and more.

- Predicting risk status and progression by deepening the understanding of the impact of illnesses on given populations, along with the costs of various models of care.

- Informing clinical resource requirements like planning staff schedules for acute and post-acute facilities, with the help of A.I.-driven predictions on the number of admitted patients, their lengths of stay and the progression of their conditions.

## Delivering Better Outcomes

McKinsey identifies A.I. as one of the emerging technologies poised to deliver hundreds of billions of dollars in additional value to the health care industry by 2025, while also driving exponential improvement in outcomes.

The technology needed to bring about that change is already here, Iansiti and Lakhani state in "Competing in the Age of AI." The more significant challenge, Lakhani says, is organizational change. The health care industry model is ripe for change, he says, and evolving technologies can speed the process.

"If 100 years of management literature is of any use to us — changes in operating models are super difficult to get done."

Despite the challenges, A.I. tools and datasets like those provided by Inovalon are helping to deliver better care at a lower cost, with much-needed benefits to payers, providers, life sciences organizations, pharmacies and, most important, to patients.

"We still have a long way to go," Dr. Dunleavy says. "But you're seeing the benefits of advancing data technologies in patient care and lowered health care costs. We see the benefits accelerating nicely."