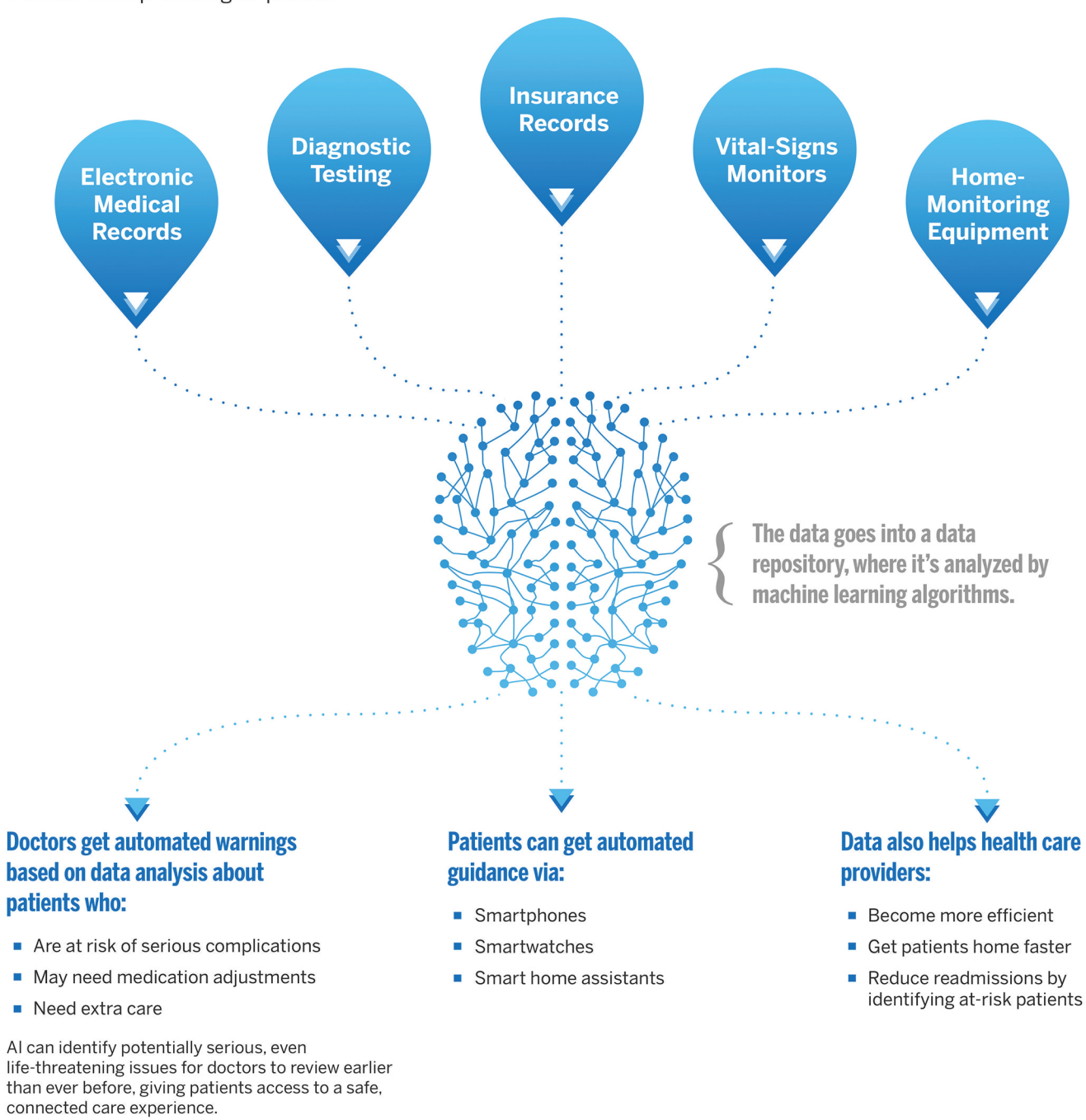# HOW AI IS CHANGING HEALTHCARE

Data from healthcare now takes up over **1.2 zettabytes**[1]—equivalent to more than **250 billion DVDs**[2]—and is growing faster than any other industry: **36%** per year.[3] Artificial intelligence initiatives can use that data to help improve healthcare.

PATIENT CARE

A healthcare organization gathers data related to patients—**over 8 petabytes per year**,[4] the equivalent of more than 2 billion smartphone digital photos:[5]

- Electronic Medical Records
- Diagnostic Testing
- Insurance Records
- Vital-Signs Monitors
- Home-Monitoring Equipment

{ The data goes into a data repository, where it's analyzed by machine learning algorithms.

Doctors get automated warnings based on data analysis about patients who:
- Are at risk of serious complications
- May need medication adjustments
- Need extra care

AI can identify potentially serious, even life-threatening issues for doctors to review earlier than ever before, giving patients access to a safe, connected care experience.

Patients can get automated guidance via:
- Smartphones
- Smartwatches
- Smart home assistants

Data also helps health care providers:
- Become more efficient
- Get patients home faster
- Reduce readmissions by identifying at-risk patients
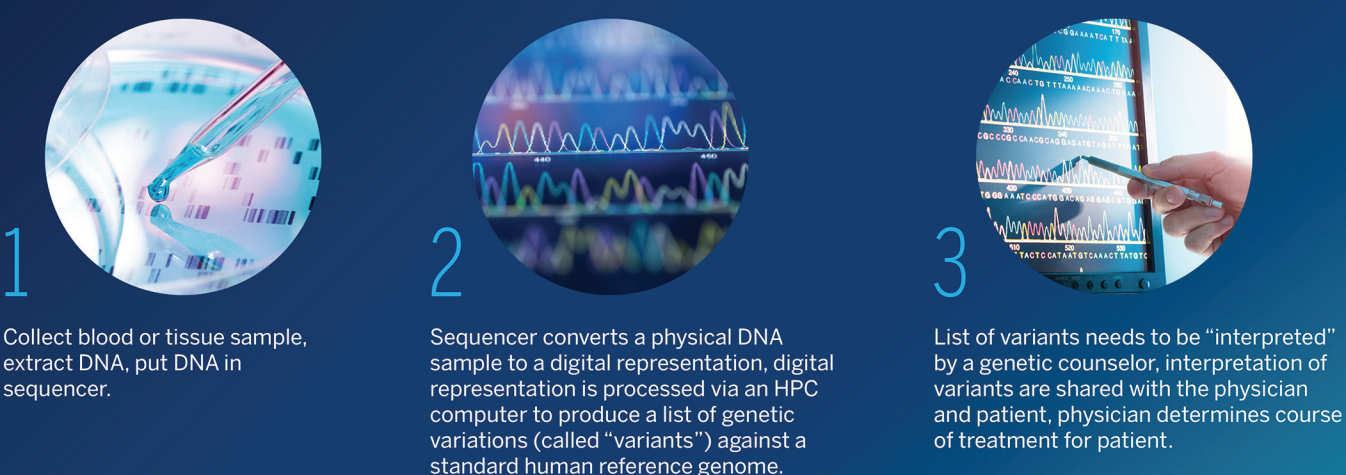
GENOMICS

The human genome has **3 billion base pairs**—the DNA from one single cell stretched out would be more than 6 feet.

Researchers can use genetic data from thousands of patients to create a machine learning model that can find anomalies and enable doctors to develop new treatments for cancer and other diseases.

Over **300 million people** have rare diseases that have a genetic cause, and **95% of rare diseases** don't have standard, approved treatments.[6]

Machine learning helps scale precision medicine, speeding the accurate review of genomic data so doctors can provide personalized treatment, even for the rarest conditions.

DNA sequencing/analysis process:

1 Collect blood or tissue sample, extract DNA, put DNA in sequencer.

2 Sequencer converts a physical DNA sample to a digital representation, digital representation is processed via an HPC computer to produce a list of genetic variations (called "variants") against a standard human reference genome.

3 List of variants needs to be "interpreted" by a genetic counselor, interpretation of variants are shared with the physician and patient, physician determines course of treatment for patient.

MEDICAL IMAGING

Procedures including X-rays, MRIs and ultrasounds generate over **600 million images a year**.[7]

AI can quickly analyze this data, identifying potential anomalies and sending them to doctors to review. This can help doctors identify rare conditions like pneumothorax, or collapsed lung, enabling them to potentially save thousands of lives.

DRUG DISCOVERY

Developing a new drug can take over **five years** and cost as much as **$2.6 billion** in research and development.[8]

Machine learning can speed this up dramatically, by:
- Analyzing and screening thousands of molecules that are potential drug candidates
- Narrowing down potential treatments by finding the right molecule with unique properties
- Creating virtualized pre-trials to model treatment options
- Supporting genomic screening of clinical trial candidates for new trials and retrospective analysis of past trial data

One company recently developed and tested a new potential treatment for fibrosis in under two months:[9]
- They trained their algorithm with a database of molecules known to be linked to fibrosis
- The algorithm identified 30,000 potential drugs
- Researchers and computers reviewed the data and narrowed it to a half dozen candidates to test further

The process took **46 days** and cost **$150,000**. The traditional process for this type of drug development could have taken as long as eight years and cost millions of dollars. Using machine learning in the drug discovery process can save pharmaceutical companies as much as **$70 billion by 2028** and bring countless treatments to patients faster.[10]

1. IDC White Paper, Data Age 2025, sponsored by Seagate, Nov. 2018.
2. At 4.7 GB each, 1.2 zettabytes is equivalent to roughly 256 billion single-sided DVDs.
3. IDC White Paper, Data Age 2025, sponsored by Seagate, Nov 2018.
4. "Driving Real Clinical and Business Outcomes with a Modern IT Infrastructure," Dell Technologies, 2019.
5. Based on 12 megapixels per photo stored in JPEG format at 100%.
6. "Response by Rare Diseases International to Draft Concept Note Towards WHO's 13th General Programme of Work 2019-2023," Rare Diseases International (RDI), October 2017.
7. "Medical Imaging Market Analysis, Size, Trends | United States | 2016-2022 | MedSuite," iData Research, October 2016.
8. Advocacy: Research & Development, Pharmaceutical Research and Manufacturers of America (PhRMA).
9. Zhavoronkov, A, et alia, "Deep Learning Enables Rapid Identification of Potent DDR1 Kinase Inhibitors," Nature Biotechnology, September 2019.
10. "Global Artificial Intelligence in Drug Discovery Market Size Analysis, 2018-2028," Bekryl Market Analysts, June 2018.