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*insideBIGDATA Guide to*

# How Data Analytics is Transforming Healthcare

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# How Data Analytics is Transforming Healthcare

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## Data-driven healthcare

When the average person imagines cutting-edge medical research, they picture doctors and scientists in white coats surrounded by chemicals, beakers, and specialized equipment. But the truth is that some of today's greatest medical innovations come from a very different setting — people sitting at computers running analytics software.

This is no secret to people involved in the healthcare industry, of course. Administrators, physicians, researchers, and students are all aware that data analytics is in the process of transforming healthcare around the world. In fact, a Stanford Medicine report on "The Rise of the Data-Driven Physician" revealed that "nearly three-quarters of all medical students and nearly half of all physicians are planning to pursue additional education in data-oriented such as advanced statistics and data science."

In addition, organizations are investing vast sums in analytics technology. Market researchers say that the global healthcare analytics market will likely be worth $39.7 billion in 2022 and is increasing at a 19% compound annual growth rate (CAGR).

Similarly, a Huron Consulting Group report titled "Embracing Healthcare's Digital Transformation" found that nearly half of healthcare leaders surveyed (47%) are looking to data management and analytical decision making to help their organizations grow.

However, that same report added, "Digital, technology, and analytics strategies exist for nearly all organizations, yet only 30% have begun to execute on those plans."

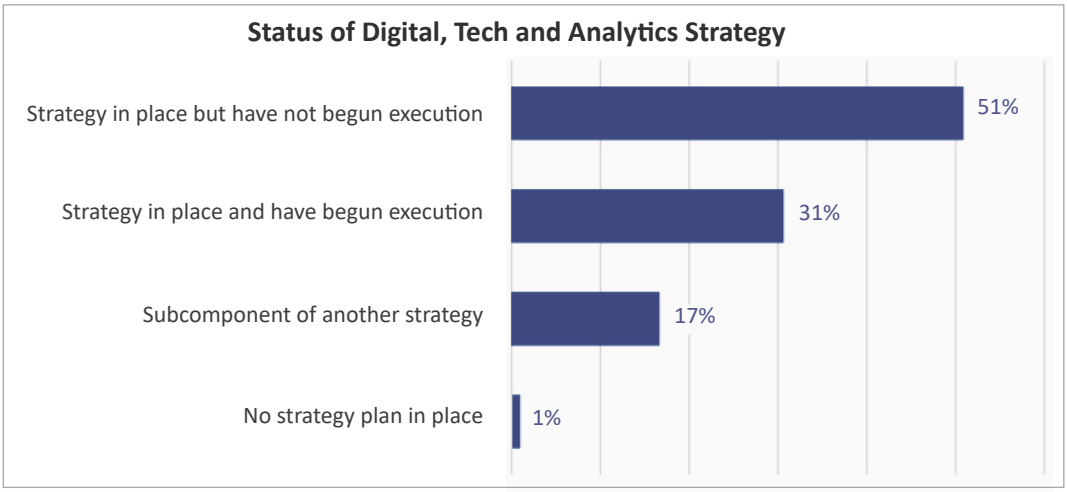
If your organization is one of the many that is still in the early stages of implementing its big data analytics strategy, you likely still have many unanswered questions. This guide provides an overview of some of the trends influencing big data in healthcare, the potential benefits, likely challenges, and recommended next steps.

### What is big data?

Most definitions of big data center around the "three Vs:"

- **Volume:** a very large quantity of data
- **Velocity:** data that is generated and/or processed very quickly
- **Variety:** data that comes from a wide variety of sources and exists in many different formats

Some descriptions also throw in a fourth or even a fifth V — **veracity** (the data may or may not be accurate) and **value** (the data has monetary worth). When embarking on a new big data project, many experts recommend that you start by quantifying the volume, velocity, variety, veracity, and value of your data.




*Source: Huron Consulting Group, Embracing Healthcare's Digital Transformation, 2021*

# Trends affecting big data in healthcare

Why has data analytics become so important to medical professionals? In part, the trend toward data-driven healthcare is part of a larger trend that spans multiple industries. Technological advances have made it much more affordable to store big data while also enabling faster data processing and advanced techniques like machine learning.

However, several trends specific to the healthcare industry are also contributing to greater use of big data analytics in the medical field. Here are four of the most important:

## 1 ELECTRONIC HEALTH RECORDS

Around the world, regulatory bodies have been encouraging healthcare organizations to adopt electronic health records (EHRs). In the United States, legislation like the HITECH Act and the 21st Century Cures Act has helped drive EHR adoption and encourage greater interoperability.

According to Stanford Medicine, 87% of U.S. physicians make use of EHRs in their practice, and HealthIT.gov reports that more than 96% of U.S. hospitals use EHRs.

Many organizations have found that complying with the laws regarding EHRs also have financial benefits for the organizations. These financial benefits are prompting them to expand their use of electronic records. In fact, Huron Consulting Group found that 62% of healthcare leaders expect to make investments in EHR and enterprise resource planning (ERP) systems over the next 18 months.

All those electronic records mean that organizations have a lot more data available that they can use for data analytics projects.

Technological advances have made it much more affordable to store big data while also enabling faster data processing and advanced techniques like machine learning.

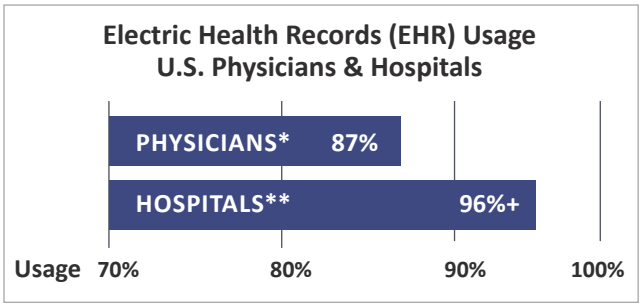
## 2 WEARABLE HEALTH MONITORS

Another trend that is adding to the growing volumes of available medical data is the number of consumers who are buying and using wearable health monitors. Fitbit, Apple, Samsung, and a host of other manufacturers offer smartwatches, wristbands, smart rings, and other devices that can monitor your:

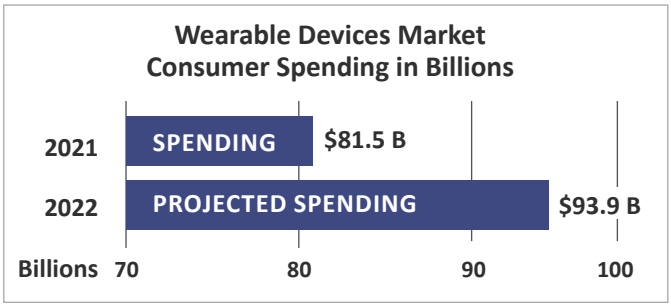
- heart rate
- step count
- breathing rate
- oxygen saturation
- skin temperature
- sleep
- activity history, and more

Those devices are tremendously popular. According to Gartner, consumers spent an estimated $81.5 billion on wearable devices in 2021. And in 2022, the market will likely grow to $93.9 billion.

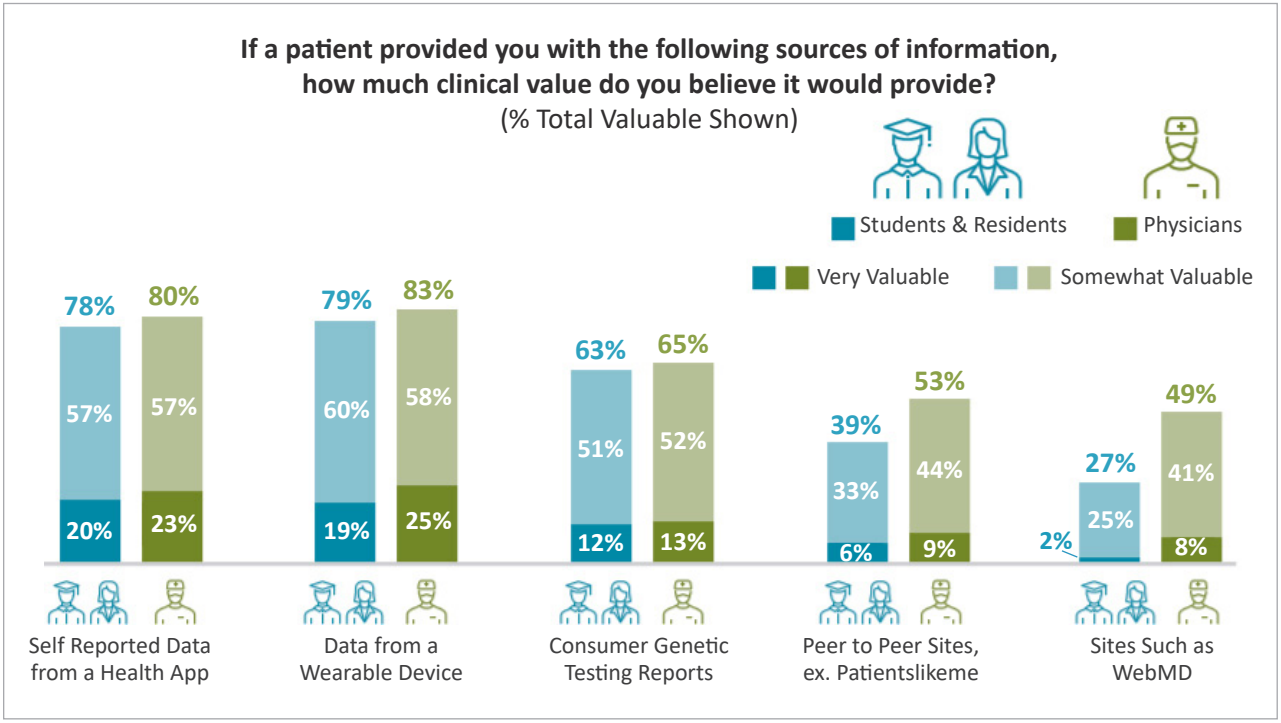
Not only are consumers using this data to inform their own daily decisions, they are also increasingly sharing it with their physicians and other healthcare providers. In the Stanford survey, 83% of physicians believed this data was at least somewhat valuable. And interestingly, 71% of physicians surveyed said they use the results or data from their own wearable devices to help inform their personal healthcare decisions.




*Source: *Stanford Medicine; **HealthIT.gov*




*Source: Gartner*




*Source: Stanford Medicine, "The Rise of the Data-Driven Physician", 2020*

## 3 GENETICS

Many of the same technological advances that have made it more affordable to store and process big data have also made genetic sequencing much more widely available. The first time scientists completely sequenced a human genome, it took 13 years and about a billion dollars. Today, consumers can order a kit that provides some DNA analysis within a few weeks for under $100. And some machines available to researchers can sequence an entire human genome in just an hour.

Already, genetics is playing a larger role in diagnosis and treatment of many diseases, and experts say that trend is likely to increase in the coming years.

Physicians are taking note. Among physicians from the Stanford survey who were planning to take classes to learn about new innovations, 38% planned to take classes in genetic counseling.

This genetic data is also adding to the total quantity of big data in healthcare, and it opens up a lot of new opportunities for research.

## 4 ARTIFICIAL INTELLIGENCE

Not too long ago, artificial intelligence (AI) was the stuff of science fiction. Today, most of us use AI every day in the form of smartphone voice assistants, recommendation engines, facial recognition, voice-to-text transcription, smart home devices, and more.

AI also has some specific uses for healthcare, such as using visual processing algorithms that can read scans or medical assistants that can help physicians more accurately diagnose ailments. According to the Stanford survey, "Almost 40% of physicians, students, and residents see the potential for AI to transform healthcare in the next five years."

One of the most significant areas where AI could improve business of healthcare is in the back office. In a Huron Consulting Group survey, 60% of healthcare leaders said that they expect robotic process automation (software that handles repetitive tasks) and/or AI tools to help drive down costs.

## Benefits of big data in healthcare

Experts say that analytics can answer just about any question that you are trying to answer, provided you have enough data. As a result, the potential benefits of big data in healthcare are limited only by the imagination of the people thinking up the questions.

That said, most healthcare organizations are focusing their big data analytics on answering a few key questions, like "How can we improve our patients' health?" or "How can we make our organization more efficient?"

Here are some of the most notable benefits resulting from big data analytics in healthcare:

### IMPROVING PATIENT OUTCOMES

The number one goal of most healthcare organizations is to improve the health of the people they serve. Big data analytics is already helping patients lead longer, healthier lives in a number of ways:

- Identifying the most effective ways to prevent and treat opioid addiction
- Tailoring cancer treatment to the type of disease and the DNA of the patient
- Providing real-time alerts about potentially dangerous drug interactions or poor treatment decisions
- Providing health advice based on data collected by wearable monitors
- Tracking the Covid-19 pandemic
- Analyzing imaging scans for signs of illness or injury
- Alerting hospitals when people with mental illness are overusing the emergency room and would be better served by another form of treatment
- Determine which patients need to come in for an office visit and which would be best served by telemedicine
- Developing new therapies and drugs for treating diseases
- Preventing suicide and self-harm in at-risk patients

This is only a handful of the hundreds of different ways that healthcare organizations are using data analytics to find better ways to diagnose and treat disease.

### STREAMLINING THE BUSINESS OF HEALTHCARE

Every organization experiences waste and inefficiency, but the problem is particularly acute in the healthcare industry. A 2021 report from McKinsey found that administrative costs account for about $1 trillion of the $4 trillion that the United States spends annually on healthcare. According to the firm, simplifying the administration of healthcare in the United States could result in savings of up to $265 billion — more than a quarter of a trillion dollars — per year.

> Smart staffing based on big data analytics can help organizations make sure that they have the right number of staff available for the number of patients they are likely to see on a given day while maximizing the effectiveness of the available work pool.

Big data analytics can help with this process in a number of ways. For example, the coronavirus pandemic highlighted just how critical staffing and supply chain management are for care providers. Smart staffing based on big data analytics can help organizations make sure that they have the right number of staff available for the number of patients they are likely to see on a given day while maximizing the effectiveness of the available work pool. Analytics can also help improve supply chain management, as well as helping catch fraud and inaccurate claims. Analytics also enables strategic planning that helps hospitals, public health agencies, and other organizations better prepare to meet the future needs of their communities.

### PROVIDING THE RIGHT TRAINING FOR STAFF

Any healthcare facility is only as good as its staff. Big data can help you identify staff members that might benefit from additional training, whether that is surgeons who need more practice with the latest techniques, back-office workers who need to learn systems and procedures, or staff members who need to improve communication or other soft skills.

### ACCELERATING RESEARCH

The process of conducting rigorous scientific studies always take time. But big data analytics speeds up that process by allowing researchers to comb through existing data stores to find new insights. Machine learning algorithms can find correlations between data that may have previously eluded scientists. These techniques can be particularly effective when you combine data collected by many different research teams.

### ENHANCING CYBERSECURITY

Healthcare organizations are a favorite target of cyberattackers. And during the Covid-19 pandemic, the rate of attacks increased. According to some estimates, nearly 90% of healthcare providers have experienced a data breach. But by investing in cybersecurity tools that make use of big data analytics, healthcare organizations can increase their ability to prevent, detect, and mitigate security incidents.

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### PREDICTING AND PREVENTING FUTURE DISEASE

One of the most exciting areas of big data analytics for healthcare relates to predictive analytics. With these tools, providers are able to forecast what diseases their patients are most likely to contract and take proactive steps toward prevention. These tools have proven particularly helpful for patients with chronic conditions, such as diabetes, because it can help them identify when they are at risk of complications and get necessary care in a timely manner.

## Challenges of big data in healthcare

In order to realize all the potential benefits of big data analytics, healthcare organizations will also need to overcome some significant obstacles. Here are five of the most significant:

### 1 REGULATION

Because of the need for patient privacy, healthcare is one of the most heavily regulated industries on the planet. Any project that deals with patient or institutional data will require strict governance to make sure that it complies with all relevant regulations.

In many cases, organizations will also need to have policies and procedures in place that allow patients to access and potentially delete their personal data should they choose to do so.

In some regions, such as the European Union, governments prevent private data from being stored or processed outside the home country. This can make it difficult or unadvisable to use public cloud computing services for data storage or analytics.

Organizations may also need to anonymize and/or encrypt data in order to comply with relevant regulations. And in many cases, they will also need to have policies and procedures in place that allow patients to access and potentially delete their personal data should they choose to do so.

### 2 LACK OF STANDARDIZATION

Different organizations record and store data in different formats. That can make it extremely difficult to combine data from different sources and come up with any meaningful conclusions.

For example, a Wall Street Journal article about efforts to create a cancer database reported that the agency involved "found more than 60 different versions of how white blood cell counts — a fundamental biomarker for cancer patients — were recorded." The amount of data cleansing required to standardize data in these situations can be daunting. However, some regulation that promotes interoperability among EHRs is helpful to improve the situation — albeit slowly.

### 3 DATA QUALITY

The conclusions you can draw from your big data analytics are only as good as the data feeding those solutions. Poor data quality and biased data are problems that plague analysts in all industries, but it can be particularly problematic in healthcare, where the stakes are so high.

Harvard's Xiao-Li Meng, the Whipple V.N. Jones Professor of Statistics, says that doing an analysis based on biased data is worse than doing no analysis at all. "If you have the resources, invest in data quality far more than you invest in data quantity," Meng said. "Bad-quality data is essentially wiping out the power you think you have. That's always been a problem, but it's magnified now because we have big data."

### 4 DATA SILOES

Another chronic problem for healthcare organizations is the existence of data siloes. Organizations use a lot of different systems and applications that all have their own data stores. Most healthcare big data projects require significant effort in getting information from the places where it resides into a centralized system where it can be combined with other data and analyzed.

> "If you have the resources, invest in data quality far more than you invest in data quantity. Bad-quality data is essentially wiping out the power you think you have. That's always been a problem, but it's magnified now because we have big data."
>
> – Xiao-Li Meng, the Whipple V.N. Jones Professor of Statistics, Harvard University

### 5 HARDWARE REQUIREMENTS

In order to process the workloads generated by big data analytics, you need the right infrastructure. That means flexible servers with fast processors and GPUs that can handle the demands of machine learning and predictive analytics. You'll also need fast storage and hardware designed to scale out as your data volumes continue to grow.

## What should you do today?

If your healthcare organization is like most, you have probably begun to dabble with big data analytics, but you have far to go before you are maximizing the potential benefits. The good news is that it is possible — and even preferable — to start small and then scale your efforts.

> Instead of trying to wrangle all your organization's data into one massive data lake, begin by identifying opportunities for significant improvements that require a smaller amount of effort.

Experts recommend the following steps:

**STEP 1 –** ENGAGE YOUR STAFF.

Big data analytics has the potential to benefit nearly every department in your organization. Start by discussing the possibilities with your staff members and get their ideas for how big data analytics might help your organization accomplish its goals and become more efficient. Your workers are your best source of insights into the questions you need your analytics to answer, and engaging them early can help you generate support that will be critical in later stages of your efforts.

**STEP 2 –** LOOK FOR "QUICK WINS."

One of the biggest mistakes that healthcare organizations make in regard to big data analytics is that they try to do too much too soon. Instead of trying to wrangle all your organization's data into one massive data lake, begin by identifying opportunities for significant improvements that require a smaller amount of effort. These pilot projects are much more likely to generate a positive return on investment, and you can complete them much more quickly. They also help build your team's expertise and the excitement around doing more with your data. Once you have a few successes under your belt, you can think about tackling a larger initiative.

**STEP 3 –** GET THE RIGHT INFRASTRUCTURE IN PLACE.

To support your big data analytics initiative, you'll need to have the right combination of hardware, software, and/or services in place. Your IT team will need to conduct a thorough review of the assets your organization already has, as well as an assessment of what will be necessary to support your efforts as they grow. Performance, flexibility, and scalability will be key. You'll also need to keep your compliance requirements in mind, which may limit your ability to use cloud services. *(See sidebar.)*

**STEP 4 –** SCALE OVER TIME.

As you experience success, you'll want to make big data analytics tools available to more teams within your organization. Use what you learned in your initial projects to optimize your later efforts. As your efforts expand, you'll find more useful data and more ways to apply your analytics tools to answer questions that are important to your organization.

**STEP 5 –** CONTINUE LEARNING.

A big data analytics project is never truly finished because the data volumes continue to grow and the available technology continues to improve. New advances in artificial intelligence and machine learning are making new approaches possible on an almost daily basis. By staying abreast of the latest developments, your team will be better positioned to take advantage of new opportunities as they emerge.

The Huron Consulting Group report summarized the current situation well when it said, "The acceleration of digital tools, technology, and analytics within healthcare continue to be the industry's greatest challenge and opportunity. Looking ahead, digital tools and data analytics will underpin the transformation of all aspects of business operations and care delivery." You can help keep your organization at the forefront of this transformation by investing in big data analytics technology and supporting your staff as they implement analytics projects.

## Choosing the right infrastructure for big data analytics

When it comes to big data analytics, you need servers with powerful performance, flexibility, and scalability. One of the most popular choices is the Dell PowerEdge R7525 server with AMD EPYC™ processors and AMD Instinct™ GPUs. This data center powerhouse offers a number of features that make it ideal for healthcare data analytics, including the following:

- **Blazing fast processors:** The R7525 has two AMD EPYC processors with up to 64 cores each. That allows the server to process a lot of different data in parallel, which is ideal for machine learning and other advanced data analytics.
- **GPUs designed for high-performance computing:** The AMD Instinct accelerators offer up to four times faster performance than competing GPUs on high-performance computing workloads. It also offers more memory capacity and bandwidth, allowing it to handle intense AI applications with ease.
- **Plenty of memory:** Being able to hold more data in memory speeds analytics applications. With up to 4 TB of DDR4, the R7525 offers fast performance, even with extremely large data sets.
- **Scale-out storage:** Big data requires big storage. The R7525 supports up to 24 NVMe all-flash vSAN Ready Nodes, for maximum speed and data storage capacity.
- **Faster data transfer:** Thanks to PCIe Gen 4, the R7525 also transfers data much faster, helping to reduce overall latency.
- **Advanced security:** Healthcare organizations have extreme security and privacy needs, and PowerEdge servers offer cyber-resilient architecture. You can further enhance security with AMD Secure Memory Encryption (SME) and Secure Encrypted Virtualization (SEV).

For more information, visit delltechnologies.com/healthcare.