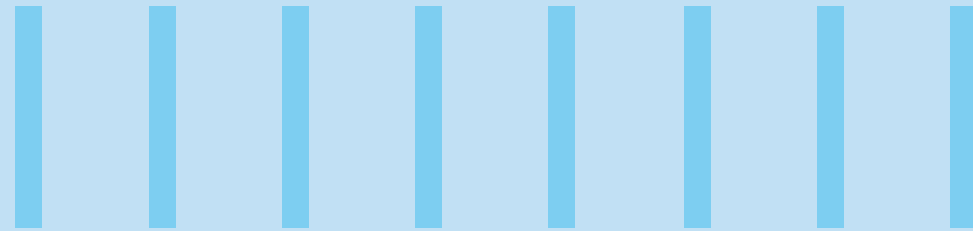# DIGITAL DATA ANALYTICS SOLUTIONS FOR HEALTHCARE RAW DATA

Abstract

The healthcare industry is one of the largest producers of raw data worldwide. This data emerges from patient care in hospitals, diagnostic centres and clinics and from research and development of new drugs. Other data sources are third-party equipment suppliers and medical insurance agencies.

Data analytics can dive deep into this big data pool and extract valuable insights that help optimise resource utilisation, lower the cost of treatment, and provide a better outcome of patient care with minimum trauma.

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The healthcare sector accumulates vast raw data from hospitals, clinics, diagnostic centres, government healthcare departments, and consulting and insurance companies. One can assess the amount of raw data from the market size, which will increase from $12bn in 2021 to $33bn in 2030.

This indicates that the healthcare sector will continue to generate more data through Electronic Health Records (EHRs), patient portals, master patient indexes (MPIs), mobile applications, and insurance records. Data analytics on this raw data can help hospitals, insurance companies, and external service providers make valuable business decisions and provide personalised treatment to patients.

Data analytics in healthcare

Data analytics in the healthcare sector influences treatment options and healthcare delivery. Early detection of diseases and treatment with greater precision are just some of the direct benefits for the healthcare sector.

The Covid-19 pandemic pushed the healthcare sector to adopt digital tools and analytics quickly. Some examples of digital tools are telehealth, personal devices to monitor patient health, and Social Determinants of Health (SDoH) databases.

Benefits of data analytics in healthcare

From predicting chronic diseases such as cancer to drug discovery, data analytics is playing a key role in the healthcare industry. Some of its benefits are –

• Make the raw data meaningful to provide valuable insights for better healthcare

• Calculate the accuracy of insurance rates and claims per insured person

• Automate low-impact administrative tasks such as admission form filling in hospitals and claims form filling for insurance companies

• Share relevant patient data within the hospital and with third parties such as insurance companies and diagnostic centres, ensuring a seamless patient experience

• Forecast any changes in the market and respond proactively. For example, data analytics could help hospitals predict the rise in patient admissions and prepare accordingly by stocking up the drugs and setting up the staff

• Secure patient data from unauthorised access and usage

• Reduce doctor visits to the patients

• Health insurance companies can calculate the accurate premium amount based on patient lifestyle and past hospitalisation trends

• Identify high-risk patients easily and provide a personalised insurance policy based on their needs

• Use early diagnosis and predictive analytics for faster drug discovery

Types of data analytics in the healthcare industry

From capturing and understanding past trends to predicting the need for logistics and human resources in the future, the types of data analytics are as follows –

• **Descriptive analytics** – It helps understand the historical trends based on the patient data from your hospital and the third-party entities you partner with. These third parties could include insurance agencies, diagnostics centres, drug manufacturers and suppliers, and research and development agencies.

It also aids pattern recognition from past events, such as pandemics and a sudden surge of certain diseases due to environmental or lifestyle factors.

• **Predictive analytics** – The information from descriptive analytics helps predict the future. This could include the usage of certain medicines and medical supplies and the in-house staff of nurses and doctors.

• **Prescriptive analytics** – This helps you unearth new strategies to provide better healthcare while optimising the costs and resource allocation. For example, the Covid-19 pandemic made the hospitals allocate most of their resources to patient care for the disease. While this was a reactive approach, hospitals can make this proactive with better data analytics.

• **Discovery analytics** – This is where hospitals and drug companies invest in research and development to discover newer and more efficient drugs. Discovery analytics also plays a key role in lowering the cost of existing treatments and medicines to make healthcare affordable.
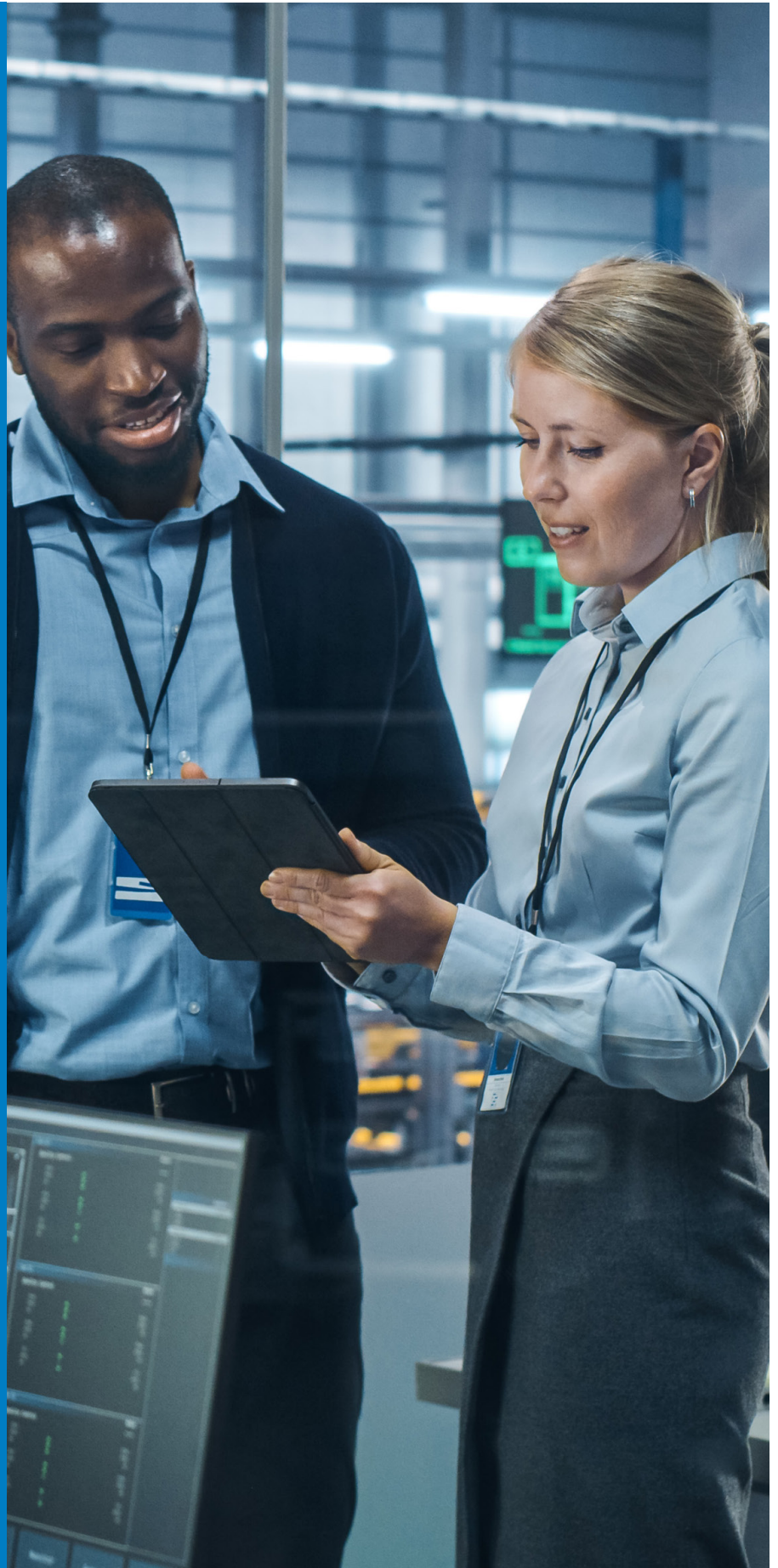
How has data analytics helped in the Covid-19 pandemic?

The pandemic outbreak highlighted the need for data analytics for faster results. Hospitals and healthcare organisations use it in the following ways –

Impact forecasting

As the raw data about symptoms, hospitalisation days, severe health conditions, and individual patient responses started appearing, researchers used it to analyse and predict the pandemic outcomes.

The data helped hospitals predict the severity of the ailment and a patient's survival probability. The data models consider the age of the patient, type of

Covid-19 case, and minimum oxygen saturation. This predictive analysis has helped healthcare professionals save many lives.

Demand planning

The hospitals were facing an alarming rise in patient admissions. During the initial days of the pandemic, many hospitals were not prepared and delayed admissions, doctor availability, and the supply of medicines and other supplies.

Using a data analytics model, hospitals could eventually predict the availability of beds, doctor schedules, patient discharge patterns, and medical supplies. The model

extracted data from patient details, bed allotments, and doctor schedules to help predict the demand.

Traceability and mapping

Data analytics helped researchers and drug developers trace the origins of the virus and develop the cure quickly. Traceability also helped identify those who got the infection due to physical contact with a person who was already sick.

Traceability and mapping helped in faster drug discovery and slowed the spread of the virus, thus saving us from a much worse outcome.

Data analytics applications in daily healthcare operations

Covid-19 was an emergency that needed immediate attention. However, data analytics helps stakeholders in the healthcare sector manage their day-to-day operations and reduce costs. Some of the applications are –

• **Resource prediction** – Resource costs account for 60% of the hospital budget. Overallocation of resources can increase the cost of operations, and under-allocation can jeopardise the quality of service. Some patients require specialised

nurses and support staff and the hospital must know when and how many to allocate.

Data analytics allows efficient scheduling and planning of hospital staff as per the patient's needs.

• **Strategic planning** – Data analytics helps the senior management make strategic decisions, such as investments in new research or expansion of healthcare services. Decision makers can assess the

ROI and partner with third parties that give the maximum value at the lowest cost.

One of the largest healthcare systems in the western US saved $2.2mn over 16 months by using data analytics for labour management. The new system reduced the time spent on scheduling from four hours to just 15 minutes. Better strategic planning results in more successful treatments, which increases the patient's trust in the hospital.

• **Electronic health records (EHRs)** – Patient records are spread in different departments of a hospital and with external parties such as diagnostic centres and insurance companies. EHRs bring all this data together and store it in an organised manner.

From lab reports to medical history, allergies, lab results, and diagnostic reports, EHRs create digital records of a patient that the hospital and third parties can access anytime. EHRs also provide indicators for regular health check-ups.

• **Better treatment outcome** – The goal of the healthcare system is to treat the patient with minimal trauma that comes with the process. Patient data analysis gives a clear understanding of the healthcare environment that helps develop, test, and implement better healthcare processes. Hospitals can reduce re-admission rates, identify the at-risk population, and reduce errors.

• **Fraud handling** – Well-organised data can help identify vulnerabilities in the hospital and insurance systems to predict possible data breaches and insurance frauds. Fraud detection and handling help insurance companies process legitimate claims faster and give cash advances to patients without delays.

• **Distribution and logistics** – Any delay in logistics in the healthcare industry could pose a big risk to someone's life. Healthcare data analytics allows the seamless distribution of medicines and equipment to the hospital facility. Hospitals use data analytics to plan operations and reduce variability in the supply chain.

Patient-reported Outcome Measures (PROMs)

PROMs focus on outcomes that matter to the patients, such as recovery from acute illness, living well while managing a chronic health condition, and maintaining dignity at the end of one's life.

Patient data analytics help assess their physical and mental health, ability to complete daily activities, energy level, and the pain they experience (if any). Healthcare providers view this information under various categories, including anger, depression, anxiety, fatigue, pain interference, pain behaviour, physical function, and satisfaction with social activities.

Data analytics can read these intangible parameters and provide meaningful insights for decision-makers.

Technologies in healthcare data analytics

Artificial intelligence (AI)

AI collects and analyses data from customer service calls, star ratings, online forms, interactive voice responses (IVRs), and other digital means. This helps extract patient sentiment around medical staff, communication, waiting times, medical prescriptions, and more.

This data mining helps hospitals offer better healthcare. It also helps research organisations run advanced clinical trials that prevent the outbreak of epidemics.

The key technologies under Natural Language Processing (NLP) that mine data from text and voice are semantic search, sentiment analysis, and Named Entity Recognition (NER).

Cloud computing

Cloud computing in healthcare data analytics creates an optimal environment for scaling operations and efficient data sharing. Patient data can flow not only from EMRs but also through healthcare

apps and wearables. Cloud computing environments are foundations for a single source of truth accessible by all departments while keeping costs low.

Health Information Exchanges (HIE)

Countrywide networks of HIEs provide interoperability in modern healthcare. HIE helps the industry in the following ways –

- Reduce costs by avoiding medical errors and duplicate testing

- Avoid incomplete data that increases medication

- Eliminate unnecessary paperwork of moving patients between care settings

- Improves public health reporting and monitoring

- Acts as the backbone of technical infrastructure for national and state-level initiatives

Machine Learning (ML)

Machine learning uses patient data to develop better diagnostic tools for analysing medical images. For example, ML helps analyse X-rays, CT scans, and MRI scans. It identifies patterns in the imaging to indicate a particular disease that helps doctors make quick and accurate diagnoses.

Conclusion

Raw data has limited value unless we extract and restructure it for suitable decision-makers. Unfortunately, the number of healthcare institutions using its potential is far less than it should be.

However, more innovative institutions realise the potential for data analytics, increasing the global market at a rate of 7.5% between 2019 and 2027.

Data analytics will affect almost all areas of healthcare, including disease prediction, resource optimisation, better logistics, and drug development.

* For organizations on the digital transformation journey, agility is key in responding to a rapidly changing technology and business landscape. Now more than ever, it is crucial to deliver and exceed on organizational expectations with a robust digital mindset backed by innovation. Enabling businesses to sense, learn, respond, and evolve like a living organism, will be imperative for business excellence going forward. A comprehensive, yet modular suite of services is doing exactly that. Equipping **organizations with intuitive decision**-making automatically at scale, actionable insights based on real-time solutions, anytime/anywhere experience, and in-depth data visibility across functions leading to hyper-productivity, Live Enterprise is building connected organizations that are innovating collaboratively for the future.

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