

**Usage of Big Data Analytics in Healthcare**



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**Introduction:**

Big data has a significant usage in the Healthcare industry, right from analyzing the historic data to

predicting the robust techniques to treat patients and all the way in discovering new technologies to prevent

health issues in patients. The healthcare industry has experienced a major transformation in the past few

years, mostly due to the adoption of advanced technology.

Big Data analytics has played a particularly important part in these, offering enormous promise

for improving patient outcomes, optimizing clinical procedures, and drastically altering the healthcare

environment. This study is to investigate the many uses of big data in the healthcare industry, emphasizing

how it may facilitate intelligent decision-making, offer novel insights and enhance predictive modeling.

Big Data analytics' introduction into the healthcare industry signifies a departure from customary

procedures. This study explores the many facets of this data-driven change, emphasizing its importance in

identifying meaningful patterns. It looks at how this change may affect the diagnosis of illnesses,

personalize care plans and enhance patient care administration.

**Literature review:**

The shifting healthcare environment is inextricably linked to the revolutionary power of Big Data

analytics. Research papers like "The use of Big Data Analytics in healthcare" (Batko & Ślęzak, 2022)

emphasize how important it is to extract significant patterns and correlations from large datasets

connected to health in order to get insights for wise decision-making in healthcare settings. Additionally,

the scoping review by Schulte and Bohnet-Joschko (2022) emphasizes the potential of Big Data to

support people-centered and integrated health services, advocating for a more patient-centric healthcare

system through personalized treatment approaches. The systematic review by Mehta and Pandit (2018)

synthesizes existing literature, offering a comprehensive overview of the concurrence of Big Data

analytics and healthcare, showcasing the synergies that have the potential to revolutionize traditional

healthcare approaches.

Cozzoli et al.'s comprehensive study of the organizational implications of big data in healthcare

(2022) offers a theoretical framework for comprehending how big data analytics might be used to

healthcare organization management. Borges do Nascimento et al. (2021) provide an overview of

systematic reviews and suggest future study options as they dive into the larger influence of Big Data

analytics on public health and individual well-being. Ramesh and Santhi's exploration of Big Data

analytics in health care (2020) sheds light on its potential to facilitate intelligent networks and

revolutionize health informatics, contributing to the ongoing evolution of healthcare practices. The

comparative study by Akundi et al. (2020) specifically focuses on the role of machine learning algorithms

within the realm of Big Data in healthcare, providing insights into the effectiveness of different

approaches.

**Advantages of using Big Data in Healthcare:**

Big Data analytics introduction into the healthcare industry has brought about a number of

benefits and opened up new avenues of opportunity that will have a big influence on patients, medical

staff, and the larger healthcare ecosystem. The ability of improved predictive analytics to help medical

practitioners foresee possible health problems is one notable advantage (Batko & Ślęzak, 2022). This is

accomplished by analyzing large databases and finding patterns and trends that allow for proactive

intervention and early illness identification.

Enhancing illness diagnosis is also greatly aided by the incorporation of big data. Healthcare

practitioners can enhance patient outcomes by making timely and well-informed diagnostic judgments by

evaluating a variety of data sources, including genetic information and electronic health records (EHRs)

(Mehta & Pandit, 2018). The capacity to tailor treatment plans based on unique patient data is another

significant benefit. By considering each patient's distinct genetic composition, way of life, and medical

background, big data analytics makes it easier to customize treatment regimens. According to Schulte

and Bohnet-Joschko (2022), the use of a tailored strategy not only improves treatment efficacy but also

lowers the probability of undesirable consequences.

In the healthcare industry, resource allocation efficiency is critical and big data helps ensure

optimal resource use (Hansen et al., 2014). Hospitals and other healthcare facilities may better manage

their resources with the use of data-driven insights, which will save operating costs, shorten wait times,

and enhance overall service delivery (Cozzoli et al., 2022). Big Data analytics enables real-time

monitoring and action, enabling medical practitioners to keep an eye on patients' health issues in real-

time (Wang & Hajli, 2017). This is especially helpful for taking care of long-term illnesses and making sure

that important problems are handled quickly (Cozzoli et al., 2022).

Big Data allows researchers to evaluate large datasets, which speeds up the pace of discovery in

the field of medical research (Borges do Nascimento et al., 2021). This improves the creation of novel

medications and therapies and speeds up the research process and clinical trials (Ramesh, Santhi,2020).

Big Data also helps with population health management plans that are all-encompassing. Healthcare

practitioners may enhance the general health of communities by identifying health patterns, allocating

resources for preventative measures, and implementing targeted treatments through the aggregate and

analysis of data at the population level (Akundi et al., 2020).

In conclusion, the integration of Big Data in the healthcare industry offers several benefits such as

greater population health management, optimum resource use, tailored treatment, improved predictive

analytics, and faster research and development. Using Big Data effectively is essential to improving

patient outcomes, expanding medical research, and building a more responsive and efficient healthcare

system as the healthcare environment changes.

**Challenges of using Big Data in Healthcare:**

Although the use of big data analytics to healthcare presents revolutionary opportunities, there

are several issues that must be carefully considered. Concerns about data security and privacy are

further exacerbated by the sensitivity and secrecy of healthcare data (Batko & Ślęzak, 2022). Since

genetic data and electronic health records (EHRs) include a great deal of personal information, strong

security measures are needed to prevent cyberattacks and illegal access. A further layer of complexity is

introduced by adhering to privacy laws, such as the Health Insurance Portability and Accountability Act

(HIPAA), which highlights the continuous need to strike a balance between the preservation of patient

privacy and the use of data for insights.

A major obstacle to the application of big data analytics is ensuring the accuracy and

dependability of healthcare data (Mehta & Pandit, 2018). Erroneous insights can result from biased

analyses caused by inadequate, inconsistent, or inaccurate data in datasets. To ensure the reliability of

the insights obtained by Big Data analytics, strong data governance rules, standardized data formats, and

frequent validation procedures must be established. The wide range of platforms found in healthcare

systems present major obstacles for interoperability and data integration (Cozzoli et al., 2022). The

smooth flow of information is hampered by disparate systems that generate and store data in disparate

forms. To fully utilize Big Data, a comprehensive perspective of patient health must be possible, and

collaborative research must be made easier by establishing established protocols for data interchange

and interoperability (Schulte & Bohnet-Joschko, 2022).

Another issue with the widespread application of big data analytics in healthcare is ethical issues

(Akundi et al., 2020). Careful consideration must be given to matters like getting informed permission,

guaranteeing openness in data usage and resolving the possibility of bias in algorithms. Ethics rules and

regulations need to be continuously refined in order to strike a balance between the extraction of

important insights and ethical concerns, especially when working with vulnerable groups (Borges do

Nascimento et al., 2021).

The efficient application of big data analytics in healthcare is also significantly impacted by

infrastructure and resource limitations (Ramesh & Santhi, 2020). Many healthcare companies, particularly

the smaller ones, may have challenges with resources, technology infrastructure, and qualified staff. To

overcome these obstacles, healthcare personnel must receive sufficient training in interpreting and using

Big Data insights. As the healthcare sector develops further, it will be crucial for data scientists,

legislators, healthcare practitioners, and technology specialists to work together to overcome these

obstacles (Hansen et al., 2014). It emphasizes how important it is to get over these obstacles in order to

fully realize the transformative potential of Big Data analytics in patient care and healthcare

administration.

**Technologies and Methodologies in the utilization of Big Data in Healthcare:**

A wide range of technologies and approaches are used in the application of big data analytics in

healthcare, all of which have a revolutionary effect on patient care and healthcare administration. Some of

which are listed below:

1. **Data Acquisition and Integration:** Gathering and combining various datasets is the first step in

the Big Data analytics process in the healthcare industry. Massive amounts of data are produced

by medical imaging, genetic data, electronic health records (EHRs), and real-time patient

monitoring. A full picture of patient health is made possible by technologies such as Health

Information Exchanges (HIEs), which enable data from several sources to be interoperable

(Mehta & Pandit, 2018).

1. **Cloud Computing:** The scalability and accessibility of Big Data solutions in the healthcare

industry is greatly influenced by cloud computing. Flexibility and economy are made possible by

the cloud's capacity to store and handle massive datasets. The computing capacity needed for

sophisticated analytics and machine learning algorithms is provided by cloud-based platforms like

Microsoft Azure and Amazon Web Services (AWS) (Cozzoli et al., 2022).

1. **Data Warehousing:** The storage, management, and organization of enormous volumes of

healthcare data depend on data warehousing. Healthcare firms may store both structured and

unstructured data efficiently with the help of technologies like data warehouses. In clinical and

administrative contexts, this organized storage helps prompt decision-making by enabling quicker

query processing and real-time analytics (Batko & Ślęzak, 2022).

1. **Machine Learning and Predictive Analytics: Big** Data analytics in the healthcare industry

relies heavily on machine learning algorithms. These algorithms use patient data from the past to

find trends and forecast future health outcomes. According to Wang and Hajli (2017), predictive

analytics helps medical practitioners with proactive patient management, tailored treatment

planning, and early illness diagnosis.

1. **Natural Language Processing (NLP):** NLP technologies make it possible to extract important

information from unstructured data sources like medical literature and clinical notes. According to

Hansen et al. (2014), NLP improves comprehension of patient narratives and helps find pertinent

insights for diagnosis and therapy.

1. **Data Governance and Security Solutions:** It is critical to guarantee the security and integrity of

medical data. Encryption technologies and data quality guidelines are examples of data

governance systems that support the preservation of data correctness and guard against illegal

access. Researchers are looking at ways to improve data security and keep an auditable record

of data transfers using technologies like blockchain (Hansen et al., 2014).

1. **Wearable Devices and IoT:** Real-time patient data is added to Big Data analytics through the

integration of wearable devices and the Internet of Things. Fitness trackers and smartwatches are

examples of wearable technology that continuously gathers health data. IoT devices in healthcare

facilities improve monitoring capabilities and help provide streaming data that is available for

analysis in real time (Ramesh & Santhi, 2020).

**Conclusion:**

The application of big data analytics is changing patient care and healthcare administration in the

ever-changing field of healthcare. This transition is driven by important technologies and techniques.

Comprehensive insights are made possible by cloud computing, data warehousing, and diverse data

collecting. Natural language processing enhances patient narratives, while machine learning and

predictive analytics provide tailored treatment regimens.

Analytics are improved by real-time patient data contributed by wearable technology and the

Internet of Things. Notwithstanding these advancements, issues like data security and moral dilemmas

continue to exist. It is essential to have strong data governance and to keep researching ethical

frameworks. In order to fully utilize Big Data and create a future where healthcare is efficient, innovative,

and individualized, politicians, data scientists, and healthcare practitioners must work together as

technology evolves.

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