Healthcare Data Management & Analytics

Nikhlesh Lakhmani
R.V.College of Engineering, Bangalore, India.

Abstract: Big data analytics in healthcare is evolving into a promising field for providing insight from very large data sets and improving outcomes while reducing costs. Its potential is great; however there remain challenges to overcome. This paper describes the promise and potential of big data analytics in healthcare.

1. Introduction

In the ever evolving pharmaceutical landscape with extended timelines and huge costs associated with clinical trials, it has prompted a new application on improving the operational efficiency of clinical data. Data management has been gaining importance in all business functions. It is an essential component of business decision making in the 21st century [2]. Every business is moving from “experience” based decision making to predictive data based decision making. This paper focuses on clinical data management and analytics at various phases during conduct of clinical trials. Pharma analytics is extensively deployed both prior and post to the launch of a drug. Focus is on analytics for marketing resource allocation, analytics for clinical trials operations optimization, modeling and simulation for pricing in developed markets for pharma products and social media analytics for understanding consumer behavior [3].

Clinical trials generate immense operational data, but functional data silos and numerous applications often hinder leaders who need a comprehensive view of their clinical trials portfolio over multiple global sites to make informed decisions. As a result, many hours are spent collecting and massaging diverse data needed to optimize trial operations and improve cost and resource efficiencies [4].

2. Four ‘V’ of big data analytics in healthcare

Analytics associated with big data is described by three primary characteristics: volume, velocity and variety (http://www-01.ibm.com/software/data/bigdata/). Over time, health-related data will be created and accumulated continuously, resulting in an incredible volume of data [8]. The already daunting volume of existing healthcare data includes personal medical records, radiology images, clinical trial data FDA submissions, human genetics and population data genomic sequences, etc. Newer forms of big data, such as 3D imaging, genomics and biometric sensor readings, are also fueling this exponential growth [7].

Advances in data management, particularly virtualization and cloud computing, are facilitating the development of platforms for more effective capture, storage and manipulation of large volumes of data [4]. Data is accumulated in real-time and at a rapid pace, or velocity. The constant flow of new data accumulating at unprecedented rates presents new challenges. Just as the volume and variety of data that is collected and stored has changed, so too has the velocity at which it is generated and that is necessary for retrieving, analyzing, comparing and making decisions based on the output [8].

Healthcare data has been traditionally static—paper files, x-ray films, and scripts. Velocity of mounting data increases with data that represents regular monitoring, such as multiple daily diabetic glucose measurements (or more continuous control by insulin pumps), blood pressure readings, and EKGs [5]. Meanwhile, in many medical situations, constant real-time data (trauma monitoring for blood pressure, operating room monitors for anesthesia, bedside heart monitors, etc.) can mean the difference between life and death [6].

Future applications of real-time data, such as detecting infections as early as possible, identifying them swiftly and applying the right treatments (not just broad-spectrum antibiotics) could reduce patient morbidity and mortality and even prevent hospital outbreaks. Already, real-time streaming data monitors neonates in the ICU, catching life-threatening infections sooner [6]. The ability to perform real-time analytics against such high-volume data in motion and across all specialties would revolutionize healthcare [4]. Therein lies variety.

As the nature of health data has evolved, so too have analytics techniques scaled up to the complex and sophisticated analytics necessary to accommodate volume, velocity and variety [8]. Gone are the days of data collected exclusively in electronic health records and other structured
formats. Increasingly, the data is in multimedia format and unstructured. The enormous variety of data—structured, unstructured and semi-structured—is a dimension that makes healthcare data both interesting and challenging.

3. How Clinical Analytics Work

In the ever-changing field of medicine, providers are at the forefront in decision making. In order to make decisions based on clinical and evidence based medicine, proper assessment and utilization of data is being used [7]. In order to offer the best quality of care for a patient, medical and health care providers must have access to the right information at the right time. Medical professionals must know what data exists and be able to utilize the data in the right way to offer the best care for the patient [3].

Too many times have health care providers been faced with a medical situation and offered a wealth of statistical information but were unable to decipher the importance or specific details that were needed for care [9]. Clinical analytics and intelligence alleviates these problems and allows clinicians to extract the exact data needed to provide the best quality of care for their patients [4].

A number of fields and systems are used to offer information and statistics in the health care organization [5]. These systems may include pharmacy, labs, billing, finance, patient claims, and more. Business or clinical analytics extract all of the data from the systems and put it into a centralized repository that is neat and concise. Decision making is made more efficient and purposeful [1, 6].

4. Conclusion

Big data analytics has potential to transform the way healthcare providers use sophisticated technologies to gain insight from their clinical and other data repositories and make informed decisions. In the future we’ll see the rapid, widespread implementation and use of big data analytics across the healthcare organization and the healthcare industry.

5. References


