Big Data-The Future of Healthcare, Impacts And Uses

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Abstract- *Big data is already changing the way business decisions are made — and it's still early in the game. However, because big data exceeds the capacity and capabilities of conventional storage, reporting and analytics systems, it demands new problem-solving approaches. With the convergence of powerful computing, advanced database technologies, wireless data, mobility and social networking, it is now possible to bring together and process big data in many profitable ways.Big data solutions attempt to cost-effectively solve the challenges of large and fast-growing data volumes and realize its potential analytical value. For instance, trend analytics allow you to figure out what happened, while root cause and predictive analytics enable understanding of why it happened and what is likely to happen in the future. Meanwhile, opportunity and innovative analytics can be applied to identifying opportunities and improving the future..*

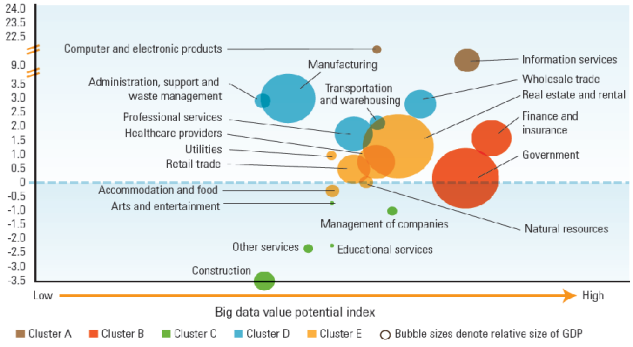
I. WHAT IS BIG DATA?

A large amount of data becomes "big data" when it meets three criteria: volume, variety and velocity (see Figure 1). Here is a look at all three:

Volume: Big data means there is a lot of data — terabytes or even petabytes (1,000 terabytes). This is perhaps the most immediate challenge of big data, as it requires scalable storage and support for complex, distributed queries across multiple data sources. While many organization already have the basic capacity to store large volumes of data, the challenge is being able to identify, locate, analyze and aggregate specific pieces of data in a vast, partially structured data set.

Variety: Big data is an aggregation of many types of data, both structured and unstructured, including multimedia, social media, blogs, Web server logs, financial transactions, GPS and RFID tracking information, audio/video streams and Web content. While standard techniques and technologies exist to deal with large volumes of structured data, it becomes a significant challenge to analyze and process a large amount of highly variable data and turn it into actionable information. But this is also where the potential of big data potential lays, as effective analytics allow you to make better decisions and realize opportunities that would not otherwise exist.

Velocity: While traditional data warehouse analytics tend to be based on periodic — daily, weekly or monthly — loads and updates of data, big data is processed and analyzed in real- or near-real-time. This is important in healthcare for areas such as clinical decision support, where access to up-to-date information is vital for correct and timely decision-making and elimination of errors. Current data is needed to support automated decision-making; after all, you can't use five-minute-old data to cross a busy street. Without current data, automated decisions cannot be trusted, forcing expensive and time-consuming manual reviews of each decision.



Big Data Gives Big Oppurtunities

Big data has many implications for patients, providers, researchers, payers and other healthcare constituents. It will impact how these players engage with the healthcare ecosystem, especially when external data, regionalization, globalization, mobility and social networking are involved Bringing the Patient into the Loop.The healthcare model is undergoing an inversion. In the old model, facilities and other providers were incented to keep patients in treatment — that is, more inpatient days translated to more revenue. The trend with new models, including accountable care organizations (ACO), is to incent and compensate providers to keep patients healthy. At the same time, patients are increasingly demanding information about their healthcare options so that they understand their choices and can participate in decisions about their care. Patients are also an important element in keeping healthcare costs down and improving outcomes. Providing patients with accurate and up-to-date information and guidance rather than just data will help them make better decisions and better adhere to treatment programs. In addition to data that is readily available, such as demographics and medical history, another data source is information that patients. At the same time, patients are increasingly demanding information about their healthcare options so that they understand their choices and can

participate in decisions about their care. Patients are also an important element in keeping healthcare costs down and improving outcomes. Providing patients with accurate and up-to-date information and guidance rather than just data will help them make better decisions and better adhere to treatment programs.In addition to data that is readily available, such as demographics and medical history, another data source is information that patients divulge about themselves. When combined with outcomes, high-quality data provided by patients can become a valuable source of information for researchers and others looking to reduce costs, boost outcomes and improve treatment. Several challenges exist with self-reported data:

Accuracy: People tend to understate their weight and the degree to which they engage in negative behaviors such as smoking; meanwhile, they tend to overstate positive behaviors, such as exercise. These inaccuracies can be accounted for by adjusting these biases and — through big data processing — improve accuracy time.

- **Privacy concerns:** People are generally reluctant to divulge information about themselves because of privacy and other concerns. Creative ways need to be found to encourage and incent them to do so without adversely impacting data quality. Effective mechanisms and assurances must be put into place to ensure the privacy of the data that patients submit, including de-identification prior to external access.

- **Consistency:** Standards need to be defined and implemented to promote consistency in self-reported data across the healthcare system to eliminate local discrepancies and increase the usefulness of data. Usage guidelines follow standards.

- **Facility:** Mechanisms based on e-health and m-health — such as mobility and social networking — need to be creatively employed to ease members' ability to self-report. Providing access to some de-identified data can simultaneously improve levels of self-reporting as a community develops among members.

II. THE BENEFITS OF BIG DATA ANALYTICS

Business value of big data is accrued when the data is analyzed properly not just collecting and storing. The benefits of using analytics in decision making to the extent of 5-6% higher productivity compared to the conventional business firms according to IBM Institute for Business Value that surveyed a global sample of nearly 3,000 executives.

Impact of Big Data on Healthcare
5 Ways big data can change healthcare

Perhaps fiscal concerns, more than any other factor, are driving the demand for big-data applications.After 20 years of steady increases,health-care expenses now represent 17.6 percent of GDP nearly $600billion more than the expected benchmark for a nation of the United States' size and wealth.The report outlines five ways data will enable the healthcare industry to cut costs and improve quality.

Right living: Data can help patients to take an active role in their own health such as diet, exercise, and medication adherence to takecontrol of their health.

Right care: Data can improve outcomes, reducing medical errors.Application of big data tools will facilitate evidence-based care that is personalized to the specific patient.

Right provider: Proven outcomes for patients to receive the best medical care based on data that helps us better match the provider's skill set with the needs of the patient and allow assessment of specific providers.

Right value: Cost-effective healthcare through different methods, such as patient-outcome reimbursement and eliminating fraud, waste,and abuse in the system utilizing big data

Right innovation: Innovators will be able to address all aspects of therapeutic innovation discovery, development,and safety utilizing data from past trials as well as analyzing trends from current data.Healthcare providers can analyze patient history data, real-time data from monitors, clinical factors, lifestyle choices and social determinants to provide a holistic view of the patient and develop the most effective care plans.

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III. HOW BIG DATA IMPACTS HEALTHCARE

- Google Flu Trends: a service that predicts and locates outbreaks ofthe flu by making use of information aggregate search queries.
- The San Francisco-based Global Viral Forecasting Initiative (GVFI)uses advanced data analysis on information mined from the Internet to identify comprehensively the locations, sources and drivers of local outbreaks before they become global epidemics.
- Analysis of mobile and Internet data could lead to huge public gains and social welfare.
- Health has been the first area of commercial application of this technology for IBM.Watson's ability to understand questions and context, and to rifle through 200 million

pages of data and provide precise responses in just seconds, can help a physician treating a patient to consider all related texts, reference materials, prior cases,and the latest knowledge in journals and medical literature.

- Accenture targets the 4% chronically ill patients that tie up more than 60% of the hospital resources Through a service that monitors readmission to hospital.
- Monitoring patients' conditions is made on the basis of medical and lab records, as well as self-reporting of key parameters from instruments available to the patients.
- In the area of patient monitoring and management, many hospitals have started to apply big data analytics in the care of chronically ill patients to reduce cost per patient and to avoid unnecessaryadmissions to hospitals.
- IBM, through their 'Smarter Cities' initiatives, has support homecare of chronically ill patients

IV. USE OF BIG DATA IN FINANCE

- Insurance uses
- Fraud Detection and Analysis
- Personalised Pricing
- Customer Sentiment Analysis
- Catastrophic Planning
- Call Detail Record
- Loyalty Management
- Social Media Analytics
- Advertising and Campaign Management

V. IMPACT ON LIFE SCIENCE BIG DATA

Big Data is the Big Challenge

The problem in healthcare isn't the lack of data but the lack of information that can be used to support decision-making, planning and strategy. As an example, a single patient stay generates thousands of data elements, including diagnoses, procedures, medications, medical supplies, lab results and billing. These need to be validated, processed and integrated into a large data source to enable meaningful analysis. Multiply this by all the patient stays across the system and combine it with the large number of points where data is generated and stored, and the scope of the big data challenge begins to emerge. And this is only a small part of the healthcare data landscape. Outlined below are some of the specific challenges of healthcare big data, including healthcare as a technology laggard, data fragmentation, security, standards and timeliness.

Security

The entire healthcare system can realize benefits from democratizing big data access; for example, researchers can more easily collaborate, engage in peer review and eliminate duplication of efforts. Researchers will also be able to more readily identify opportunities where they can contribute and collaborate.

The cloud makes exposing and sharing big data easy and relatively inexpensive. However, significant security and privacy concerns exist, including the Health Insurance Portability and Accountability Act (HIPAA). A credentialing process could facilitate and automate this access, but there are complexities and challenges. Since providers, patients and other interested parties such as researchers need secure access, data access should be controlled by group, role and function. Finally, the security of the data once it leaves the cloud also needs to be assured. Big data can be used to identify patterns and irregularities indicating and preventing security threats, as well as other types of fraud.

Timeliness

Data timeliness is a challenge in various healthcare settings, such as clinical decision support, whether for making decisions or providing information that guides decisions. Big data can make decision support simpler, faster and ultimately more accurate because decisions are based on higher volumes of data that are more current and relevant. In some cases, there is a very limited window for clinical decision support — significantly smaller than the time it takes to run a report or analytic query. Careful attention to data and query structure, scope and execution is needed to ensure that the constraints of the processing windows are observed while still obtaining the best possible answer. In other cases, streams of data containing complex and varied events without an overarching structure need to be mined. In this case, those events have to be turned into meaningful measures in real time that are, in turn, suitable for rapid analysis. In many cases, the only practical solution is to discard most of the data after analyzing it and selectively store those results. It's a tradeoff between the competitive advantage gained from the shorter feedback loop and the quality of the information that is being fed back. Capturing only processed data, streaming or otherwise, results in a loss of data at the expense of creating information. The underlying principle of big data is to keep everything, but in some cases that's just not practical or even useful — sometimes the hoarder reflex has to be checked and rational decisions made.

Choices of Big Data

There are numerous technology solutions for dealing with big data, ranging from on-site to cloud and from open source to proprietary. On-site options that can tame big data include Teradata, Vertica (HP) and Netezza (IBM). All of these solutions tend to have low time to value and maintenance but relatively high total cost of ownership.Cloud-hosted software as a service (SaaS) solutions can help reduce the barriers of participating in the big data arena. Google and Amazon implement MapReduce-based solutions to process huge datasets using a large number of computers — e.g., terabytes of data on thousands of computers. MapReduce algorithms take large problems and divide them into a set of discrete tasks that can then be distributed to a large number of computers for processing and the results combined into a problem solution. Other cloud-based solutions include Tableau, which supports visualization.Open-source Hadoop is a framework used by many companies as a high-performance, scalable and relatively low-cost option for dealing with big data. Training, professional services and support are needed to effectively deploy Hadoop solutions using the open source framework. Vendors such as Greenplum (a division of EMC), Microsoft, IBM and Oracle have commercialized Hadoop and aligned and integrated it with the rest of their database and analytic offerings.SaaS is an important technology for democratizing the results of big data. SaaS-based solutions allow healthcare entities that control subsets of data to expose access through services that eliminate some of the aggregation and integration challenges. Additional services that facilitate analytics, both basic and advanced, can be made part of the overall offering.

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Citation: Ajit Kumar R (2016) Impact of Big Data Analytics on Healthcare and Society. J Biom Biostat 7: 300. doi:10.4172/2155-6180.1000300

J Biom ISSN:2155-6180 JBMBS, an open access journal

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International Journal of Information Sciences and Techniques (IJIST) Vol.6, No.1/2, March 2016
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