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A FUTURE TREND IN HEALTHCARE: THE USE OF BIG DATA

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Abstract: *Big data analytics (BDA) is considered to be a relatively new trend in research which will bring new opportunities to various fields. Healthcare also benefits from this new approach which is considered to be the future trend for research and treatment as well. The present paper aims to explain the impact that this kind of approach will have in this field and also to make an analysis of the main advantages of the use of big data in healthcare and to highlight the main limitations and challenges that occur at the present time.*

Key words: *big data, healthcare, future trends*

1. Introduction

Healthcare refers to the maintenance and/or improvement of health through prevention, diagnosis, and treatment of disease, illness, injury, and other types of problems related to the physical and mental states of human beings.

The access to healthcare is different across countries, communities, and individuals, and is mainly influenced by social and economic situations as well as the health policies adopted by a certain nation.

Nations and jurisdictions adopt different policies and plans that are related to the personal and population-based healthcare objectives within their societies.

Healthcare systems are organizations established to meet the health needs of targeted populations.

Healthcare systems may provide four different types of care: primary care, secondary care, tertiary care and, in some special cases, quaternary care.

Primary care refers to the health services provided by a medical professional (such as a general practitioner, paediatrician, or nurse) with whom a patient has first contact. The aims of primary care are to give the patient a wide spectrum of preventive and curative care over a period of time and to coordinate the care that the patient receives.

Secondary care is the next step of medical care provided by a specialist or facility recommended by a primary care physician, and that requires more complex and

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specialized knowledge, skill, or equipment. The specialists should communicate with the primary care physician to ensure that the recommendations they make are not in contradiction with each other.

Tertiary care is the specialized consultative care, as a result of evaluating patient's condition by primary or secondary medical physicians, by specialists working in a centre that has personnel and facilities for special investigation and treatment. It means highly specialized medical care usually over an extended period of time that involves advanced and complex procedures and treatments performed by medical specialists in health facilities.

In most of the cases, quaternary care is considered to be an extension of tertiary care, because it is even more specialized. The fact that it is so specific makes it possible just for very few hospitals or medical centres to offer this kind of medical care.

2. What is Big Data?

The concept of big data refers to vast quantities of data—created by the mass adoption of the Internet and digitization of all sorts of information. New big data technologies promise to consolidate and analyse this gathered digital information in order to discover trends and make predictions.

McKinsey Global Institute defines big data as being "datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse".

Recent rapid increase in the generation of digital data and rapid development of computational science enable us to extract new insights from those massive data sets, known as big data, in various disciplines, including internet business and finance. (Choong and Hyung, 2017)

There are five key concepts associated with big data: *volume*, *variety*, *velocity,* and, the recently added, *veracity* and *value,* and it seems that every industry is focusing their efforts on implementing big data strategies (Martin- Sanchez and Verspoor, 2014).

By adopting big data technologies, organizations expect to gain benefits across many domains, such as e-commerce, e-government, science, health, and security (Chen et al., 2012).

Using big data can bring social and economic value. Social value includes improved social wellbeing in fields such as education (Chen et al., 2015), healthcare (Raghupathi and Raghupathi, 2014) and public safety and security (Newelland and Marabelli, 2015). Thus, social value comprises benefits for single users as well as larger societal benefits such as employment growth, productivity and, consumer surplus (Loebbecke and Picot, 2015).

Economic value can be measured by an organization's increase in profit, business growth, and competitive advantage resulting from big data adoption (Davis, 2014).

In general, big data is perceived as a source of innovative products, services and business opportunities (Davenport and Kudyba, 2016).

Thus, both the academic and the practitioner-oriented literatures are characterized by a strong focus on the opportunities that big data provides for organizations (Clarke, 2016).

3. The Use of Big Data in Healthcare

The healthcare industry, perhaps more than any other, is on the verge of undergoing major transformations through the use of advanced analytics and big data technologies (Carol McDonald, 2017).

Big Data in healthcare is being used to predict epidemics, cure disease, to improve the quality of life and avoid preventable deaths (Marr B., 2015).

Because the world's population has grown bigger and people tend to live longer, models of treatment delivery are also changing, and some of the decisions behind those changes are being related to the ability of collecting data. Today's efforts are directed towards understanding as much as possible about a patient, as early as possible and hopefully detecting clues of serious illness at an early stage when treatments can be simpler and/or less expensive than in the case of being discovered later.

Over the past few years, the synergy between healthcare and technology has taken a big leap across the world (Farshad F. et al, 2018).

With the recent "passion" of several technology giants, who are seizing the opportunity to integrate medical functions into wearable devices, the competition in the wearable device market will be quite interesting (Jing et al., 2016).

Google is aiming to diagnose types of cancer, impending heart attacks or strokes in earlier stages than today's science is able to do.

Apple's efforts are towards developing medical sensor-laden devices to monitor blood through the skin and to analyse glucose levels through tears.

Intel has launched a wearable-to-analytics devices program called "A-wear" that directly ties wearable devices with big data analytics(BDA) technology.

Samsung has a joint venture with medical professionals at the University of California, San Francisco to accelerate validation and commercialization of promising new sensors, algorithms, and digital health technologies for preventive health solutions (Jing et. al., 2016).

Big data analysis exploits various algorithms of data mining, which can be defined as the automatic extraction of useful, often previously unknown information from large databases or datasets using advanced search techniques and algorithms to discover patterns and correlations in large pre-existing databases (Lavecchia, 2015).

3.1. Main Advantages of Implementing Big Data in Healthcare

For understanding future opportunities and advantages that big data can bring to the field of healthcare we have to identify the main stakeholders first. The prominent stakeholders in healthcare usually refer to 5 main categories:

- **Patients**
- **Medical practitioners**
- **Hospital operators**
- **Pharma and clinical researchers**
- **Healthcare insurers**

It is believed that the implementation of big data will benefit all those stakeholders

and it will bring more quality and more efficiency to the healthcare field.

Among the most important advantages that can be highlighted are:

• **Patient-centric care** is a concept that differs from patient-cantered care that is defined by the U.S. Department of Health and Human Services as being "health care that establishes a partnership among practitioners, patients, and their families (when appropriate) to ensure that decisions respect patients' wants, needs, and preferences and solicit patients' input on the education and support they need to make decisions and participate in their own care." On the other hand, patient-centric care means that the information and interactions will come from the patient. Personalized medicine will incorporate filtered relevant Big Data with patient specific mined data from HER (Electronic Health Records) and patient portal including genomic data. This data collection will ultimately result in the future possibility of personalizing the prescription of medical apps and other patient management tools.

• **Reduced healthcare costs: h**ealth payers such as insurers and public health systems will be able to shift from fee-for-service compensation to value-based data-driven incentives that reward high quality, cost-effective patient care and demonstrate meaningful use of EHR (Electronic Health Records). This approach requires significant improvements in reporting, claims processing, data management, and process automation. (McDonald C., 2017)

• **Reducing waste, abuse or fraud in healthcare:** this will have a very important contribution to reducing healthcare costs everywhere in the world where this kind of systems are going to be implemented, and big data analytics is believed to become a game changer for healthcare fraud also.

The key to identifying fraud is the ability to store data and to be able to make analysis of older claims and to use machine learning algorithms to detect anomalies and patterns. BDA will be able to structure patient records and billing to highlight problems like overuse a hospital services in short time periods, patients receiving healthcare services from different hospitals in different locations simultaneously, or identical prescriptions for the same patient filled in multiple locations (McDonald C., 2017).

• **Improved Outcomes through predictive analytics: i**nitiatives like the adoption of Electronic Health Records (EHR), and the volume and detail of patient information is growing rapidly. In U.S. for example, the creation of EHR meant a $30 billion federal government stimulus, provided by the Health Information Technology for Economic and Clinical Health (HITECH) Act. The aim was to provide incentives for population to adopt EHR and then stimulate the sharing of patient information by clinicians with the purpose of reducing costs, speed diagnosis, and improve patient outcomes. Creating value out of data derived from EHRs can be used for early diagnosis and reducing mortality rates from a diverse range of health conditions.

• **Monitoring the patients in real-time** Patients can be provided with proactive care if their vital signs are monitored. The data provided by these monitoring processes may be analysed in real time and they can alert healthcare providers about all the changes in in a patient's condition. It is believed that in time this will help doctors make lifesaving decisions and effective interventions.

Real-time monitoring will change the nature of the relationship between patients and

doctors where some of the face-to-face care will not always be necessary.

• **Overall improved quality and efficiency of healthcare**: all the advantages listed above will ultimately lead to higher quality of medical care for patients and more efficient healthcare systems in the future.

3.3. Main Challenges in Implementing Big Data in Healthcare

Current reality shows that the rate of use of devices that would allow mass data collection is increasing. But there are still issues related to the uneven development of health care facilities in the world as well as the willingness of people to provide data to be collected and analysed.

So, in this case one of the major challenges is the costs that BDA is associated with. These costs mainly refer to:

-the initial cost of establishing the BDA infrastructure

-the cost of storing the data

-the costs of data analysis.

For undeveloped countries these costs cannot be covered at this time. For the more developed countries, conducting a cost-benefit analysis is crucial for any healthcare entity in order to decide if it is appropriate to invest and start using BDA. The issues of clinical integration and utility have been largely overlooked.

Another challenge refers to the patient's privacy and security, as BDA devices tend to collect personal information beyond healthcare data.

The third challenge refers to the ability of the company's BDA specialists to generate enough value for customers/patients to yield their appreciation and the further adoption of the devices and subscription for additional services. – (Jing et.al., 2016).

Another problem can occur from methodological issues, such as data quality, data, inconsistency and instability, limitations of observational studies, validation, analytical issues, and legal issues (Choong and Hyung, 2017).

4. Conclusions

It is clear that big data will have more and more impact on the field of healthcare. The high rate of devices used by people will make collecting data possible and the new processing technologies will be able to store, analyse and generate valuable outcomes which will increase the quality of patient care and the overall efficiency of healthcare systems.

There is a clear trend of moving towards evidence-based medicine which implies making use of all clinical data available. Capturing and bringing together all the information possible about a patient will give in time a clearer image for healthcare coordination, population health management, and patient engagement and outreach. Gaining this very wide perspective of the patient situation can also lower and ultimately eliminate redundant and expensive testing, it will reduce errors in administering and prescribing drugs, and, most importantly, it will avoid preventable deaths.

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