Recent Challenges of Big Data Application in Healthcare System

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Abstract: *This article explores the issues of using big data in the healthcare sector. The author reveals the general characteristics of the concept of big data, studies the issue of their application in the medical industry. The author also attaches importance to the possible consequences of the introduction of big data and their impact on privacy.*

Keywords: *Big Data, healthcare, medical law, data protection, confidentiality, personalized medical card.*

In the current realities, when every action taken leaves its mark in the digital space, the interaction of devices through the global Internet implies their digital identification linked to databases. This argument is the basis of the concept of the "Internet of things", considered as the next stage in the evolution of the development of the World Wide Web, where machines are not only producers of information, but also its consumers. At the present stage, society is characterized by a sharp increase in the volume of data circulating in it, as well as a steady trend towards an increase in the role of information in various fields of activity (including business and certain areas of public administration).

This rapid increase in the volume of data circulating around the world, and their commercial value, places a number of new requirements on the mechanisms for processing information, as well as on extracting added value from it. The answer to this challenge was the technologies that received the generalized name of "big data" in the scientific community. It should be noted that so far there has not been a generally accepted definition of the term "big data". The most common disclosure of this phenomenon is through an indication of the problems that arise in the processing of information, where big data suggests the possibility of high-performance information analysis that can provide online work. Thus, big data is a set of methods and tools for processing huge volumes of structured and unstructured information from various sources to improve the quality of managerial decision-making, increase competitiveness and create new products.

Volume, speed and variety, these three concepts are known as the main characteristics of big data. These features are the key to understanding how we can measure big data. Data volume refers to their size and how huge it is. While the second concept refers to the rate at which the data changes, or how often it is created. Finally, diversity includes multiple data formats and types, as well as different uses and ways to analyze data. It is advisable in this aspect to understand that big data is not only large amounts of information, but also technologies for its storage, and analytical processing methods.

Accordingly, big data opens up many opportunities to improve services provided to the population, improve individual industries, as well as improve the quality of life at the level of each individual. In particular, this is reflected in the healthcare system, where these technologies act as one of the most important tools, which in turn serve as an accelerator for the transition to value-based treatment. It should be noted that this model assumes a shift in the main focus on the interests and expectations of patients, which implies the subsequent distribution of resources based on the main indicators of the patient with the use of appropriate technologies. However, it

must be borne in mind that a strong regulatory framework that will not only facilitate but also encourage the correct use of digital technologies, such as big data, must accompany this transition.

Today we have unique, previously inaccessible tools and data. As Eric Topol, a digital medicine researcher, and author of the book "*How Artificial Intelligence Can Make Healthcare Human Again*", notes: "We are able to digitize and quantify almost every aspect of the human body. As by analogy with Google Maps, in which a satellite view of the area, viewing traffic jams and virtual walks through the streets of the city are available, today we can create a "medical Google Map" of the human body, which will contain information about its external features, anatomical structure, physiological processes, DNA, RNA and other biochemical indicators.

Experts also see a great potential for the use of technologies for analyzing large data arrays generated in the field of medicine and healthcare for solving many problems in the functioning of the healthcare system. The main tasks that Big Data technologies allow us to solve are monitoring the treatment process, determining the most effective methods of treatment, as well as preventing epidemics. However, it is not always possible to turn medical information into data suitable for further work. Medical information and data is currently fragmented, held in isolated repositories and incompatible systems and formats, much exists only on paper or film, and almost everything is subject to legal protection. These factors make it difficult to exchange, process and interpret even in the most advanced countries where a high technical level of medical statistics has been achieved.

At the same time, the high relevance of the introduction of Big Data technologies in medicine is also associated with new trends in the relationship between a doctor and a patient in the format of mobile medicine technologies. Medicine is becoming more and more patient-oriented, for whom prognosis, disease prevention and personalization of treatment are important. It is known that the data system can be useless without the use of the so-called "smart use approach", in particular without the involvement of Artificial Intelligence in these processes, the very presence of a large amount of data about a particular patient will not make sense. For this reason, the issue of their interdependent application in the field of medicine comes to the fore. This can allow early identification of a range of diseases that a person may face due to their genetic predisposition, lifestyle, certain factors and circumstances that affect the health history of this person.

In addition to the above-mentioned aspect of predicting certain diseases, a personalized approach will warn the patient against the permissible negative consequences resulting from the treatment and diagnosis of diseases. When making a specific diagnosis and prescribing appropriate treatment, the medical staff represented by the doctor often proceeds from the spectrum of symptoms manifested at that particular time, but not in all cases the picture of previous diseases is taken into account, as well as the methods that were used in their treatment. This, in turn, leads to the occurrence of side effects due to the use of incompatible methods and drugs, which can significantly impair the quality of life of a person. Using this aspect as a practical example there is an American company that called *Express Scripts*, which handles millions of prescriptions for home-delivered and retail pharmacy prescriptions each year. This is carried out by a special division of Knowledge Solutions, which uses analytics tools to process big data. They effectively analyze information about individual patients, which, according to company representative, vice president Tom Henry, they will soon be able to notify medical staff of serious side effects of the drug, long before it is even prescribed to the patient.

In turn, this can lead to important positive changes in the qualitative improvement of the life of the population, in particular:

➢ Health care providers will know that a patient is at risk of addiction before they can write a prescription for pain medication. In such a situation, it will be possible to choose a different treatment plan or more carefully control the consumption of drugs.

➢ On the other hand, analysis of written prescriptions, physiology and other medical information will allow detection of the development of a chronic disease or a disease that has not yet been properly diagnosed.

In particular, it is also known that no significant attention is paid to compliance with the terms of admission to X-ray or other diagnostics, which has its own requirements regarding the frequency of the using. That is, in order to avoid the consequences in the form of radiation received as a result of a diagnostic examination, it would be appropriate to create a system that could record the information received by the patient throughout his life regarding his indicators, examination results, as well as other medical prescriptions for timely notification and increase in the effectiveness of his treatment.

In our opinion, the further development of Big Data technologies in healthcare can be facilitated by the widespread creation of interregional medical databases, which at the same time have access to the database at the global level. We believe that it is advisable to take the interregional level for the first steps as the volume of information stored in them is growing so rapidly that it exceeds the throughput of existing medical information systems.

The creation of a unified database system at the regional and interregional levels will provide an opportunity to introduce a digital medical file into the healthcare system. This involves the creation of a *personalized medical card* for each person, the right to dispose of which will belong to the owner himself. However, touching upon the issue of data, and in particular personal data, which from a medical point of view constitute a professional medical secret, the primary task will be to ensure the confidentiality of data at the state level. How to ensure patient privacy? It is technically possible to "calculate" people with specific characteristics, even if the individuals themselves have not explicitly indicated them. At the same time, it is important to note that big data does not require an unambiguous indication of belonging to a particular group, they allow you to automatically identify its signs (for example, taking certain medications can indicate HIV status). If access to sensitive information about the state of physical, mental health, suicidal tendencies is opened, this can lead to discrimination in employment, inequality and violation of the privacy of the individual. It is invariable that the digital footprints that a person leaves accumulate throughout his life. This provides new opportunities for the development of various technologies, but at the same time increases the vulnerability of privacy, jeopardizing the secret of personal life. Similarly, data constituting a medical secret is increasingly in demand by third parties and, for example, may be of interest not only to commercial structures, but also to government agencies themselves.

Looking at this issue on the basis of a real example, in the UK, after a long discussion by all concerned parties, there was formulated a "Code of practice for digital and data-driven health technologies" (Updated 19 January 2021). As noted in this code, the healthcare system is a unique space in which various regulatory ecosystems intersect simultaneously. Due to the privileged nature of working with people's health and their protected data, the system is subject to various legislative acts, as well as professional and ethical standards. Innovators in this field may come from sectors that are not necessarily familiar with medical ethics and research regulations and may use datasets or other processing methods. As conceived by the creators, this code should become part of the overall digital national strategy and help create an environment that supports innovative technologies that use data, ensure security, competitiveness, compliance with ethical and legal standards.

For these purposes, we can consider the creation of uniform rules for the use of big medical data as the most rational solution. Taking into account also the fact that the development of these rules will undoubtedly depend on the priorities in resolving ethical issues and the concept of regulation of the latter by the state and society. As an acceptable solution, we can consider such measures as – the creation of a legislative framework in the field of regulation of digital data especially in the field of medicine; the appointment of a state operator or supervisory authority to work with data; and most importantly is the provision of controlled access to data.

Big data analytics in healthcare is a very time-consuming and promising process of integrating and exploring huge amounts of heterogeneous data, the combination of which forces big data analytics to simultaneously include various areas in the process, such as medical imaging, medical informatics, medical law and, accordingly, the foundations of cyber law. As a further work to improve the legal framework of the healthcare system and the introduction of rules for the use of "big data", various practices should be studied in more detail, while maintaining a balance between technological development and ensuring the confidentiality of patient data.

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