FETDE 2020

International Conference on Finance, Entrepreneurship and Technologies in Digital Economy

HEALTH DIGITALIZATION: BIG DATA TECHNOLOGY

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Abstract

The article is devoted to the application of Big Data technology in healthcare. The authors emphasize that the digital transformation of healthcare is a global trend aimed at increasing the quality of medical services and expanding their accessibility without significantly increasing the costs of their implementation. The most promising innovations include artificial intelligence (primarily in the diagnosis, development of medical products, optimization of work processes), medical Internet of things (IoMT) when monitoring the status of patients and people requiring special medical care, virtual and augmented reality (VR / AR) in the diagnosis and training of medical personnel, blockchain to increase the safety and security of medical data and professional decisions made, Big Data technology, which poses olyayut create global registries storage of medical data. According to the authors, the adoption of Big Data technology is hindered by the resistance of the conservative medical community, the lack of corporate data warehouses and real practical experience with their work, and institutional barriers.

Keywords: Big Data technology, digital economy, digital technology, digital transformation of healthcare

1. Introduction

The development of health care in recent years throughout the world is associated more with the benefits of digitalization. The digital transformation of healthcare is a global trend.

The fact is that digital technologies can simplify the availability of medical services without a significant increase in the cost of them. An important aspect of the introduction and dissemination of "digital" medicine is to improve the quality of services by reducing the number of medical errors, developing predictive medicine, and increasing the effectiveness of clinical trials (The digital revolution in healthcare: achievements and challenges, 2017). And the use of telemedicine helps to solve the problem of the lack of qualified personnel. All these advantages determine the relevance of the revitalization of digitalization in healthcare.

It is no coincidence that in recent years, investments in digital healthcare have remained at a very high level. StartUp + Health estimated the volume of investments in this market in 2019 at $ 13.7 billion. Rock Health estimated total investments in the US market alone at $ 7.4 billion. According to Silicon Valley Bank (SVB), $ 10.7 billion was attracted in the United States in 2019 to finance digital medicine development in the United States. There are 39 unicorns in the world (startup companies whose capitalization has exceeded $ 1 billion in a short period) in the total amount of $ 92.8 billion (Investing in the digital healthcare market is actively developing, 2020).

According to analysts, the global digital medicine market will reach $ 206 billion in 2020, with mobile and wireless technologies becoming its most profitable segments (6 main trends of digital medicine 2019, 2019).

The most common scenario for using Big Data technology in healthcare is the creation and maintenance of electronic medical records and their further modernization.

The promising areas that will become the main growth points in the near future include: artificial intelligence (primarily in diagnostics, development of medical products, optimization of work processes); Medical Internet of Things (IoMT) when monitoring the status of patients and people requiring special medical care; virtual and augmented reality (VR/AR) in the diagnosis and training of medical personnel; blockchain to increase the safety and security of medical data, professional decisions made, ensure anonymity; Big data (6 main trends of digital medicine 2019, 2019)

As for the latter, the spread of information technology in healthcare has led to a large-scale increase in statistical data on patients and medical cases, which required their study and analysis. Big Data is not just large volumes of information, it is new ways of collecting, processing and storing it. Standardization of data accumulated in different countries will allow medical institutions to exchange them.

In the United States, Electronic Health Record (EHR) is already used - a system that stores all possible records about the patient's condition throughout his life. Almost 94% of clinics in the country are connected to this system. According to McKinsey, the use of Big Data technology has helped improve the treatment of cardiovascular disease and brought about $ 1 billion in savings by reducing the number of visits to doctors and laboratory examinations. In 2020, a unified system of medical records in Europe will become a reality (Big Data in medicine, opportunities and application examples, 2020).

2. Materials and methods

This study is based on the analysis of theoretical approaches, statistical data and positive experience in the development of digital healthcare in Russia, the use of Big Data technology, as well as the study of foreign experience, comparative analysis and content analysis.

The novelty of the author's approach lies in the fact that digital technologies are considered, first of all, as a global process that leads not only to the transformation of Russian healthcare, but also to revolutionary changes on a global scale, especially in a pandemic.

3. Discussions and results

At its core, Big Data is a combination of approaches, tools and methods for processing huge amounts of structured and unstructured data to obtain human-perceived results (Big Data from A to Z. Part 1: Principles of working with big data, MapReduce paradigm, 2020). These are new technological opportunities for the analysis of huge data sets.

Big data differs from a typical relational (related, relative) database in that it does not have a traditional table and column structure, data is extracted from the source systems in their original form, stored in a massive, chaotic distributed file system (What is Big data). These data are consistent with the Sushi Principle (that is, data is best when they are raw, fresh and ready to eat) (Buylov, 2020).

Big Data technologies characterize "Three V": volume - the value of the physical volume; velocity - the growth rate and the need for quick processing of data to obtain results, variety - the ability to simultaneously process various types of data (What is Big data: collected all the most important about big data, 2020).

The speed of access to data and the speed of its processing are important criteria for the quality of technologies included in Big Data. Experts believe that machine learning algorithms that can find statistical correlations in a huge array of medical data will promptly produce forecasts and recommendations for the patient and his attending physician. And an analysis of all known medical histories and diagnostics will make it possible to introduce into the practice of doctors a system of support for making medical decisions (The use of Big Data in medicine, 2020).

Big Data technologies provide the opportunity to create worldwide registries of medical data storage; treatment of serious diseases (for example, using such technologies, genetic markers of different types of oncology are recognized), quick and accurate selection of necessary drugs for a particular patient, testing of new drugs (for example, the number of pharmaceutical trials using Big Data in the USA in 2017 exceeded 300) (Big data. Big data in medicine 2020).

In the United States, Big Data technologies are beginning to evaluate the effectiveness of the treatment. It is assumed that soon they will pay not so much for the treatment process as for the ability to quickly heal and maintain the health of patients.

Big Data helps predict healthcare costs. For this, a multivariate analysis of statistics such as the number of repeated visits, the percentage of complaints about specific doctors and hospitals, the prevalence of various pathologies, the number of patients with chronic diseases, and epidemiological indicators is used.

Data analysis allows you to optimize costs. Thus, employees of the National Health Service of Great Britain (NHS), using Big Data technology, were able to increase the workload of operating rooms by 2%, which ensured a saving of 20 thousand pounds per week. As a result, patients began to perform operations for health reasons faster, the length of hospital stay was reduced, the number of repeated hospitalizations decreased, and costs were reduced (Big data. Big data in medicine, 2020).

Despite the positive aspects of Big Data technologies, there are certain problems in their application. These include:

1. Security threats. Due to fears of privacy violations, people often refuse even free genetic research.

2. A large amount of unstructured, sometimes unnecessary information. Approximately 78% of medical data is not structured, and filtering and analyzing such volumes of information is too expensive.

3. The risk of making an erroneous decision. This applies both to the actions of physicians and the technologies used. A joint study by Harvard Medical School, the Beth Israel Deaconess Medical Center and the Massachusetts Institute of Technology showed that in diagnosing metastatic breast cancer, the neural network makes errors on average in 7.5% of cases, an oncologist in 3.5% of cases, but when they work together the metric value drops to 0.5% (Big data protects health: how and why medical organizations collect and store data, 2020).

4. A limited selection of solutions that are really capable of effectively working with large volumes of unstructured data. At the same time, they can be used only by the largest market players, the amount of data of which is calculated in petabytes.

Russia is slightly behind foreign countries in the use of Big Data technologies.

This is due to several factors. In Russia, as in a number of Western countries, the implementation of Big Data technologies is facing resistance from a conservative medical community.

Many organizations do not have a corporate data warehouse and, accordingly, cannot use these technologies.

Most manufacturers and integrators lack real practical experience in using Big Data technologies, which reduces the desire to introduce new solutions (The Ministry of Communications proposed to regulate big data, 2020).

In addition, the development of Big Data technologies in Russia is constrained by regulatory barriers. For example, the federal law "On Personal Data" states that the processing of medical information should be carried out by persons professionally engaged in medical activities, which limits the involvement of external analysts and IT specialists in clinics.

Another limiting factor is the high cost of solutions and the lack of fast results: Big Data processing tools require large computing power, and, therefore, are expensive to purchase, install and use.

There is a shortage of specialists, who are able to implement projects in the field of Big Data. Requires data-scientists, combining the skills of mathematics, and the developer, and business analytics. The country has not yet trained such specialists.

However, information technology cannot be ignored. The Russian Ministry of Health has developed a Healthcare Development Strategy until 2025, during the implementation of which Big Data technologies will be used.

In the meantime, these technologies are aimed solely at solving three main tasks: assisting the doctor in diagnosing and predicting the course of the disease, assessing the quality of medical care, identifying fraud in the transfer of payments between clinics, insurers and compulsory health insurance funds.

In February 2020, the Ministry of Communications and Mass Media developed a draft law aimed at regulating the big data market and draft amendments to the Federal Law "On Information, Information Technologies and Information Protection", which are under discussion.

Despite the lack of a well-defined regulatory framework, Big Data technologies are gradually taking root in healthcare. The main directions of their development are:

1. The operational activities of medical institutions: access to the experience of thousands of colleagues across the country; reducing the need for laboratory research, thanks to the proliferation of sensors connected to wearable gadgets, etc.

2. Pricing and payment system. Analysis of accounts and receipts using new technologies will reduce the number of errors and theft when paying.

3. Research and development, especially in personalized medicine. Processing giant volumes of genetic information will allow doctors to prescribe completely unique drugs and treatments.

4. New business models, such as on-line platforms for patients and doctors, medical researchers and pharmacologists;

5. Mass screening of the population, prevention and detection of epidemics. Big Data technologies make it possible to build geographical and social models of public health, as well as predictive models of the development of epidemic outbreaks.

4. Conclusion

Summing up the above, we note that Big Data technologies offer great opportunities for large-scale breakthroughs in medicine. And this is predicting the development of diseases, surgical risks, side effects of treatment, the health status of infants, and improving the quality of service.

This is especially important in the context of a constant increase in the population of the planet, quite frequent outbreaks of epidemics, the emergence of new diseases.

The digital transformation of economic sectors, the use of new technologies should become the objects of serious attention of countries seeking to improve the standard of living of the population and ensure sustainable economic growth.

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