

Digitalization of Healthcare: Domestic and Foreign Experience, Development Trends

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ABSTRACT

Currently, we are witnessing rapid changes in the modern socio-economic system through the introduction of various digital technologies. The process of digitalization and informatization can provide a breakthrough in increasing the availability and quality of services without increasing health care costs. For about 10 years in the Russian Federation, many notable information and analytical projects have been actively introduced and implemented. The authors analyzed the implementation of digital technologies in health care, which makes it possible to assert that these technologies are being successfully implemented in the Russian Federation, and the corresponding generalizations and conclusions are drawn. In our opinion, the following conditions are necessary to accelerate the digitalization of healthcare: the creation of a basic infrastructure; public-private partnerships with industry to work on interoperability and interoperability issues; attraction of external financing; promoting people-centered healthcare as a fundamental principle of digitalization.

Keywords: digital economy, digitalization of healthcare, telemedicine, artificial intelligence, electronic

medical records, human resources, quality of medical services

1. INTRODUCTION

Ensuring the availability of medical care is impossible without the widespread use of digital technologies, which make it possible to solve the problem of reference and information support for making medical decisions by providing prompt access to accurate and truthful information about the patient's health, introducing automated procedures for checking the correctness of prescribing drugs, and receiving remote medical consultations by individuals who suffer from chronic diseases that require constant monitoring and control. Taking into account the length of the Russian Federation and the distance between individual settlements, these measures are becoming especially significant.

The aim of the study is to study the achievements and prospects for the development of digitalization of healthcare in the Russian Federation and their impact on the quality of medical services to the population, the effectiveness of healthcare management.

To achieve the goal, it is necessary to solve the following tasks:

- To study how the legal regulation of digitalization of healthcare in the Russian Federation is carried out;
- To assess the domestic experience of introducing digital technologies in health care using the technical potential of the state corporation "ROSTEKH";
- Analyze foreign experience of digitalization of healthcare;

- Identify the challenges of introducing digital health care;
- Identify trends in the development of digitalization of healthcare in Russia.

2. MATERIALS AND RESEARCH METHODS

The subject of the research is the organizational and managerial relationship between the state and medical organizations during the digitalization of the healthcare sector. In the process of solving the set tasks, the methods of empirical and complex economic analysis were used.

When considering the state of digitalization of healthcare, a systematic approach was used in the analysis of regulatory legal acts, in the assessment of individual tools for digitalization of healthcare in foreign countries and in Russian practice.

3. RESULTS AND THEIR DISCUSSION

3.1. Legal regulation of digitalization of healthcare in the Russian Federation

In accordance with modern trends, the digital economy is becoming the most widespread. Russia understands this, at this stage of the country's development there is an active transition to an economy of this kind. Previously, the goal

of the information society was the penetration of information technologies into all spheres of life, reducing information inequality, but now such a society is focused primarily on the development of the economy, competitively capable of entering the international level, creating new jobs and markets. [1]

By the Decree of the Government of the Russian Federation of July 28, 2017 No. 1632-p, the Program "Digital Economy of the Russian Federation" was adopted, [2] which defines the goal of transition to a qualitatively new level of use of information and telecommunication technologies in all spheres of socio-economic activity.

The program establishes 8 directions until 2025, the successful completion of work with which should be proof that the set goals and objectives for the development of the digital economy of Russia have been achieved [3]:

- 1) State regulation;
- 2) Information infrastructure;
- 3) Research and development;
- 4) Personnel and education;
- 5) Information security;
- 6) Public administration;
- 7) Smart city;
- 8) Digital health.

It is impossible to ensure the effective functioning of the new health care model without linking it to the current model. Otherwise, the transition period may drag on and entail the provision of poor quality and untimely assistance to the population.

What should the new healthcare model be based on? First of all, on "digital" medicine. The advantages of this type of medicine are that it allows remote collection and processing of data in order to make informed decisions [4]. Digital technologies are a priority area for the development of the healthcare sector around the world. The process of digitalization and informatization can provide a breakthrough in increasing the availability and quality of services without increasing health care costs. For about 10 years in the Russian Federation, many notable information and analytical projects have been actively introduced and implemented.

According to the Program, the implementation of the project for the implementation of digital healthcare should lead to the provision of high-quality medical care to citizens using digital medical services by doctors, patients, healthcare managers of all levels and forms of ownership; affordable and high-quality medical services will contribute to an increase in the average life expectancy of the population of the Russian Federation to 76 years, an increase in the active and working age of citizens. It is planned that the implementation of the Digital Healthcare program will result in the provision of affordable medical care to the citizens of Russia at the place of demand, and an increase in the efficiency of the use of human and information resources. Also, as a result of the implementation of the Digital Healthcare program, it is planned to support the company's domestic startups in the field of information support for medical organizations.

3.2. Domestic experience in the implementation of digital technologies in healthcare using the technical potential of the state corporation "ROSTEKH"

The digital technology market is growing by a quarter annually, which indicates the priority of this area. The process can provide a breakthrough in the availability and quality of services without increasing health care costs. Therefore, the development of digital medicine is carried out with the active participation of the state. [6] Russia is no exception, where several information and analytical projects, notable on a global scale, are already being implemented. [7]

State Corporation (GC) "Rostec" is one of the largest industrial companies in Russia, uniting about 800 scientific and industrial organizations in 60 regions of the country. Key areas of activity - aircraft construction, radio electronics, medical technologies, innovative materials, etc.

The state corporation "Rostec" is a supplier of both medical equipment and a variety of digital solutions for the national project "Healthcare". The innovative developments of the Rostec State Corporation, which contribute to the preservation of the health and life of Russians, are aimed at achieving the target indicators for the national project.

One of the eight subsections of this national project is "Creation of a unified digital circuit in health care based on the Unified State Health Information System (EHISZ)". The development and support of the Uniform State Health Information System is carried out by the National Informatization Center, which is part of the Rostec State Corporation, by order of the Russian Ministry of Health.

Unified State Health Information System is a federal-level system that offers many effective services in the healthcare sector: from reference information to electronic registry, document management system and telemedicine. To date, with the help of the Rostec State Corporation, more than nine thousand medical institutions throughout the country have been integrated into the system. By 2025, almost all medical organizations in the country are expected to switch to electronic medical document management. [8]

The Shvabe holding of the Rostec State Corporation has equipped more than twenty medical institutions in the Magadan Region with hardware and software systems, and also acted as a supplier of medical equipment supporting the telemedicine function. These solutions have practical value in simplifying access to medical services and attracting national level specialists to consultations on medical cases. Complex delivery of medical equipment was carried out as part of the creation of the Unified State Health Information System in Russia.

One of the priority areas within the framework of the implementation of the national project "Health" is the reduction of infant mortality. In order to improve the quality and availability of medical care for newborns and their mothers, a project was created to build perinatal centers in the regions of Russia. State corporation "Rostec"

on behalf of the government is implementing a large-scale part of the program for the construction and equipment of clinics. Fifteen perinatal centers have already been built and equipped on a turnkey basis, with a total capacity of forty-five thousand patients per year.

An important aspect in the implementation of the Healthcare project is the development of the primary health care system. As mentioned above, taking into account the area of the Russian Federation and the presence of hard-to-reach territories in the Russian Federation, it becomes obvious that there is a need for an equipped air ambulance service. According to experts, such services can potentially be provided on 85% of the country's territory. The federal project for the development of medical aviation is being implemented by the Ministry of Health and the Ministry of Industry and Trade of Russia as part of the instructions of the President of Russia. As a result, the proportion of people hospitalized for emergency indications during the first day will grow to 90% by 2025. To date, the sanitary aviation is already working in 45 regions of the country.

State Corporation Rostec has been a key supplier of helicopter technology and medical equipment since 2016; in 2017, the organization announced its readiness to create a single operator in this area. In January 2018, Vladimir Putin supported the initiative. The government approved the National Air Ambulance Service JSC (NSSA) as the sole executor of medical aviation work for state needs. [8]

At all stages of medical care, an important aspect is the possibility of early detection of diseases and, as a result, laboratory diagnostics. In this area, there are many problems associated with the lack of uniform standards, the quality and reliability of the results that patients receive, and the development of the direction directly depends on the level of work of laboratory services.

Taking into account these problems and the specifics of the work, Rostec State Corporation launched a project to optimize and centralize laboratory services in the regions on the principles of public-private partnership (PPP). It is planned that as a result of the creation of a network of centralized clinical diagnostic laboratories, budgetary expenditures in this area will be reduced by twenty percent, it is also planned to solve the problem of inaccurate analyzes and optimize the provision of the laboratory with consumables and reagents.

Instruments for laboratory research are also being developed at the enterprises of the Rostec State Corporation. For example, the Shvabe holding has developed a thermo shaker for clinical diagnostic laboratories. The first products appeared on the Russian market in 2019.

In 2018, Russian industrialists united in the Digital Health Consortium in order to participate in pilot projects with their innovative developments. [9], [10] The purpose of such a consortium is to prepare the possibility of transferring all national medicine to the digital twin model "of every patient, no matter in what remote settlement he is. This goal can be achieved if market players timely implement new technological solutions, and the state, in

turn, will assist them in promoting these solutions. [11], [12]

For example, the Shvabe holding together with the National Medical Research Center named after V.A. Almazov will create a special digital platform for personalized medicine. It is planned that the system will collect and analyze information about the patient's condition at all stages of treatment. [13]

At the end of this section, we can conclude that the State Corporation "Rostec" in the framework of the implementation of digital technologies in healthcare solves the problems of safety, efficiency, accessibility of medical services using innovative tools in medicine.

New technologies should make the doctor's job easier by helping free all healthcare workers, from registry workers to healthcare managers or chief physicians. The most important thing that the state expects from the digitalization process is the liberation of medical workers from an endless routine. It is expected that digitalization will shift the attention of the specialist from the process of filling out the medical history (that is, formal procedures) to analyzing the case of a specific patient's illness. Hopefully, as digital healthcare evolves, healthcare professionals will be able to return to their core business: treatment, social care, and patient care.

3.3. Foreign experience of digitalization of healthcare

Digital technologies, which are often used by European countries in the framework of initiatives aimed at reforming the health care system, contribute to improving the health and well-being of the population by increasing the availability of health services and information; improving the quality of service delivery; improving the efficiency of the health care system, etc. [14]

Based on the data of foreign experience in the use of electronic medical records (EHR), we can say that this innovation greatly facilitates the process of collecting and exchanging patient data for medical personnel. Insurance companies in the leading countries of the world already include EHRs in their insurance programs. Almost half of the surveyed representatives of insurance companies in the UK, USA, France, the Netherlands and China (forty-six percent) said that access to EHR is already included in their offer. Almost half of the respondents said that they are in the process of integrating EHR into their proposals, and seven percent - that this integration is considered by them as a prospect for the near future. [6] The results of the study show that insurance companies value the idea of ubiquitous distribution of electronic health records and are ready to offer benefits to patients and healthcare institutions that will help use these technologies.

Among other things, it is important to note the need to use artificial intelligence in the healthcare of foreign organizations. This measure is intended to simplify the process of processing information for a quick and accurate

diagnosis of the disease. [15] Data analysis using artificial intelligence makes it possible to identify the processes necessary for the competent organization of medical care. The experience of many countries shows that artificial intelligence can reduce the burden on medical personnel, collect and process, analyze and store big data, make a diagnosis and help assess its correctness. Artificial intelligence makes it possible to quickly and efficiently process and analyze large amounts of data. It has been proven that in terms of the accuracy of working with data, artificial intelligence is about ten percent higher than the average doctor.

However, different healthcare professionals have different opinions about the use of artificial intelligence in the daily work of a medical organization, which significantly complicates the work with artificial intelligence and leads to a slowdown in its implementation.

For "digital" medicine, the use of specialized health monitoring tools (fitness trackers, etc.) on a daily basis is of great importance. In the modern world, it is important for people to be able to receive and transmit reliable data on their health here and now. Almost ninety percent of Americans believe that wearable devices have helped them better manage their health. [16]

In foreign countries, such as Japan, the USA, Israel, for almost twenty years, they have been actively introducing and using medical information systems (MIS), which allow accumulating huge amounts of data and making high-quality management and medical decisions based on information analysis.

Abroad, there is a significant difference not only in the financing of the healthcare sector in general, but also in the approach to creating a medical information system, the peculiarities of functioning, integration, as well as the attitude to data protection. Among other things, a different system of training specialists for the implementation and use of MIS is used, as well as methods for stimulating personnel. In particular, the following example can be cited, in Japan and Israel, attention is paid to training specialists to use medical information systems in obtaining specialized education. In America, additional seminars and trainings have to be implemented to prepare personnel for the use of MIS.

Taking into account the specifics of working with medical information systems, it should be said that the European Union pays attention to the protection of personal data of patients, avoiding the creation of a single integrated system and a single data exchange center, which entails institutional fragmentation and data integration problems. In the United States, in turn, a unified data standardization system has been clearly developed, which eliminates the problems of information integration, but does not provide the necessary security of patients' personal data. Despite sufficient funding for the healthcare sector, US medical professionals complain about the high cost of IIAs, as well as insufficient qualifications of personnel, which is typical for many countries, since the use of the system requires certain skills in working with information technology. Various methods are used to stimulate the use of the system, for example, in the United States of America - a

system of fines, in the Russian Federation - bonus incentives. A number of the following problems are currently acute:

- high cost of medical information systems;
- insufficient qualifications of specialists to work with information technologies;
- data integration;
- documentation support.

Thus, despite the difference in the timing of the introduction of digitalization of healthcare in different countries, the ideal functioning of the system does not exist at the moment.

3.4. Problems of introducing digital healthcare in the Russian Federation

Today, the Russian Federation is actively developing digital healthcare tools, the introduction of which into clinical practice will ultimately increase the life expectancy of the country's residents.

Let's highlight the following problems that complicate the introduction and implementation of digital technologies in medicine:

The first difficulty is the insufficient level of integration into a single network. In Russia, advanced projects in the field of digitalization of the healthcare sector are two information platforms: the Unified State Information System in the Healthcare Sector (Unified State Health Information System), which connects the information systems of all medical institutions and makes it possible to maintain unified electronic medical records and registers of persons with certain diseases, as well as the United medical information and analytical system of Moscow (UMIAS), operating since 2012, the number of users of which is more than nine million patients and ten thousand medical workers. [17] The connection of all state medical organizations to the Unified State Health Information System is planned by 2025. At the same time, the implementation of a project to eliminate the digital divide, which involves connecting to the Internet for residents of rural, remote and hard-to-reach areas, is still facing objective difficulties in financing [18].

The second problem of the Medical Decision Support System (DSS) raises serious doubts among doctors. Of course, artificial intelligence can be of great help by prompting the treatment algorithm necessary for a particular patient or by reminding about the need to control health, starting from the obtained test result. But, on the other hand, the question arises, whose opinion should be considered a priority in the event of a disagreement - a doctor or an artificial intelligence? Will there be a situation in which, in the event of a patient's death due to a medical error, the doctor will have to be punished, but if the tragedy occurred as a result of the decision of the SPPVR, if the specialist has a different opinion, this will be considered normal and not prosecuted by law? Experts agree that expert systems of such a plan should be viewed exclusively as a second opinion, that is, perceived by a

doctor as an auxiliary tool, and not as a substitute for his experience and knowledge.

Another problem is that the state is just beginning to develop education and professional retraining of personnel, taking into account the trends of digitalization of healthcare. In 2016, on the basis of the First Moscow State Medical University. THEM. Sechenov, the first in Russia department of information and Internet technologies in medicine was created. Currently, it is planned to open similar personnel in other universities in Russia [19]. At the Peoples' Friendship University of Russia, fourth-fifth year students learn to organize master classes in a distance format, as well as set up and conduct broadcasts of operations and diagnostic procedures. We must not forget that not only young specialists need to acquire knowledge and skills about the possibilities of telemedicine technologies, but also those under whose leadership they will work. It is also important for leaders of medical organizations to know the capabilities of this innovative tool. Without the study of the fundamentals of telemedicine by healthcare leaders, the equipment of telemedicine centers will be an ineffective asset on the balance sheet of medical organizations.

It is also possible to highlight another difficulty, which is that the development of digital health care is closely related to innovations, for the implementation of which private capital and a proven mechanism of public-private partnership are needed, with which there are problems in our country. [20] About fifty projects in the field of digital healthcare are presented in the Skolkovo Technopark in two clusters - information technology and a cluster of biomedical technologies. Projects such as Third Opinion, Botkin AI, Doc +, Ritmer, UNIM, PhtiZisBioMed can become leaders in the emerging digital healthcare market and reach capitalization exceeding \$ 1 billion. In the future, the capitalization of telemedicine companies in our country will reach \$ 30-40 million, and they will be comparable in scale of business with federal networks of medical clinics. For the successful implementation of these projects, it is necessary to attract private capital using the mechanism of public-private partnership. [21], [22]

4. CONCLUSIONS

Based on the data obtained as a result of scientific research, a number of the following relevant and timely conclusions can be drawn:

1. For modern Russia with its geographic features, namely, huge territories and remote settlements, digital technologies in healthcare are a real salvation, since they help save the time of specialists and patients, as well as provide assistance to people from remote areas, to which doctors are not can get there physically.
2. The question of how quickly digital technologies will penetrate the medical market has become central to the discussion of the digital health program. The optimistic forecast is by 2025. In segments where there is effective demand, primarily in private medicine, this will happen rather quickly. Mass medicine will follow this path

objectively slowly.

3. Key areas of development of digital medicine in the short term:

- Introduction of electronic medical records.
- Development of the "connected patient" concept - monitoring the condition and providing medical services using built-in smart devices.
- Telemedicine. [23]

4. Domestic and foreign experts of the World Health Organization believe that the following conditions are necessary to accelerate the digitalization of health systems:

- Attraction of external financing [24]
- Strengthening mutual understanding and resolving issues related to resistance
- Closer collaboration with international partners to define a common regulatory framework for digital health services [25]

5. The main advantages of digitalization of healthcare:

- Financial - cost savings by reducing patients' contacts with doctors and modernizing the organizational system for providing services.
- Social - an increase in the availability of quality medical care.
- Professional - improving the quality of services by reducing the number of medical errors, developing predictive medicine, increasing the efficiency of clinical trials.

The main achievements and prospects of digitalization of healthcare, problems, and, most importantly, the ways to solve them, highlighted by us in the article, will make it possible to ensure the availability of all types of medical care, to activate the processes of wide and rapid implementation of the latest diagnostic and treatment technologies into medical practice.

6. If we talk about human resources, the State is engaged in the development of education and professional re- and training of personnel, taking into account the process of digitalization of healthcare. In 2016, on the basis of the First Moscow State Medical University named after I. THEM. Sechenov, the only department of information technologies and Internet technologies in medicine in the country at that time was created. Currently, it is planned to open similar departments with a focus on information technology in medicine and in other universities in Russia.

7. There are significant problems hindering the introduction of information technology in medicine. In the field of legislation, the process of adaptation to new technological realities is just beginning. As you know, the Government of the Russian Federation approved a draft law on telemedicine, which allows remote medical assistance, in particular, to conduct consultations, remotely monitor the health of patients, write electronic prescriptions and certificates that will be relevant for all institutions. Also, one of the main problems is the lack of state funding for the health sector. According to the available data received from the state auditors of the Accounts Chamber, the Ministry of Telecom and Mass Communications is delaying the process of connecting state medical institutions to the Internet, the Ministry of

Health, as it became known, is late with the formation of the regulatory framework for the work of the Unified State Information System in the field of health care (YGISZ). It is expected that this will require additional budgetary costs in the future.

But in the realities of the modern world, only elements of digitalization can be observed, namely: simplification of communication, informatization, but this is not telemedicine yet, and certainly not digitalization. And further deepening in this direction opens up new issues that need to be addressed today.

Thus, digitalization of healthcare is an important and necessary process of the 21st century. It has both great development prospects and implementation difficulties. In the future, digitalization of healthcare will be able to improve the level and quality of life of the population, thereby contributing to the economic development of the country as a whole.

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