

# ***Health care digitalization in the digital economy of the Russian Federation: regional experience and directions of development***

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**Abstract** — At present, four components of public health-human capital, economy, infrastructure and modern technologies are priorities. The prospects of financial and economic development of the national economy are connected with the digital economy. It is predicted that the digital economy will change the format of existing economic relations and business models in economics. Health care digitalization is inextricably related to the economic development of the country and with all sectors of the economy. The objective of the digital economy program, aimed at improving the lives of Russians by improving the quality of goods and services produced using the latest digital technologies, is fully related to the health sector. The article considers healthcare digitalization as a complex research of positive and negative factors that can affect the quality of medical services, the performance of the state guarantees program of medical care, and ultimately, the quality of life of citizens and the implementation of the state strategic plans as a whole. The authors give examples confirming that the health care digitalization is successfully implemented in the regions of the Russian Federation, and make appropriate generalizations and conclusions.

**Keywords** — *digital economy, digitalization of health care, telemedicine, artificial intelligence, electronic medical records, human resources, quality of medical services*

## I. INTRODUCTION

The prospects of financial and economic development of the national economy are connected with the digital economy. It is predicted that the digital economy will change the format of existing economic relations and business models in economics.

This process is dynamic in all spheres of social and economic activity. In this regard, the health care system is no

exception. Financial, economic, technical, social, organizational, production business processes take place here too, as in other sectors of the economy. At the same time, there is its specific impact on the economic development through the population health preservation (reduction of mortality, especially in working age, infant and age-related mortality of children, morbidity and disability, increase in life expectancy).

Digital technologies is one of the priorities in the development of the healthcare sector worldwide, this market is increasing by a quarter every year. 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. Russia is not an exception. In Russia, several information-analytical projects of noticeable global scale are already being introduced.

In the near future, fundamentally new ways of development may emerge in the healthcare sector: digitalization of medical data, use of mobile devices to monitor and transmit medical indicators online, developing cloud services providing their storage and processing, introducing artificial intelligence to help doctors quickly take the right decisions.

The aim of the research is to study the main directions of healthcare digitalization in regions of the Russian Federation and their impact on the quality of medical services provided to the population and the effectiveness of public health management.

## II. MATERIALS AND METHODS (MODEL)

Empirical and complex economic analysis methods were used in the process of achieving the goal of the research.

## III. RESULTS AND DISCUSSION

### A. *Goals and objectives of healthcare digitalization in the digital economy of the Russian Federation*

On May 9, 2017, by his decree No. 203, the President of the Russian Federation approved the "Strategy for the Development of the Information Society in the Russian Federation for 2017–2030" [1]. It defines the digital economy as "an activity in which the key factors of production are data in digital form, the processing of large volumes and the use of the results of the analysis of which, compared to traditional forms of management, significantly improve the efficiency of various types of production, technology, equipment, storage, sales delivery of goods and services".

The concept of "Digital Economy" is not a Russian invention, in fact it is an already established world development trend. In 2014, Gartner gave the following definition: "digital business" is a new business model covering people / business / things, globally scalable for the whole world through the use of IT, the Internet, and all their properties, suggesting an effective personal service for everyone, everywhere, always".

Boston Consulting Group analysts think that digitalization is the use of online opportunities and innovative digital technologies by all participants of the economic system – from individuals to large companies and states [2].

The World Bank considers the digital economy as "a new way of the economy based on knowledge and digital technologies, within which new digital skills and opportunities are formed in society, business and the state". At the same time, they think that it is necessary to understand this phenomenon very widely, which not only concerns the IT industry, but deeply transforms all kinds of human activities.

In general, the meaning of this concept is that the future of any developed country is determined by its economic potential. Any economy of the future is a digital (electronic) economy and there can be no other economy. Accordingly, this is understood in our country and an attempt is being made to move to a new level, to look at the next planning horizon. If the previous version of the "Information Society" was viewed more as a reduction of digital inequality, as the infiltration of information technologies into various spheres, including social and cultural, and as infrastructure development, then the new option focuses on the development and diversification of the economy, competitive access to the international market, creating new jobs and even new markets.

The program "Digital Economy of the Russian Federation" [3] aims to move to a qualitatively new level of using information and telecommunication technologies in all spheres of social and economic activity.

The program includes:

- the regulatory legal base adaptation to new types of relations, new objects and subjects of the digital economy;
- the creation of infrastructure, technology and platforms that ensure the receipt, storage and processing of the amount of data that are created in a digital economy;
- ensuring non-discriminatory access to data, while ensuring the legitimate rights and interests of data subjects and owners;
- training of qualified personnel;
- ensuring information security;
- development of applied solutions for new quality of information and telecommunication technologies use in the sphere of state and municipal management.

The program establishes for the period up to 2025 8 areas of work, the implementation of which should in principle indicate the achievement of the goals and objectives for the development of the Russian digital economy, including:

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

We are interested in the Digital Healthcare Program. The project justification says:

"The health systems of Russia and practically all, both developed and developing countries of the world, have encountered systemic problems. Most of the existing health systems were created 100-200 years ago in other socio-social and economic conditions. In addition, there was a jump in the development of high-tech medical wearable means of monitoring physiological parameters, as well as implantable medical devices and remote monitoring devices. They require not just modernization, but the creation of new innovative digital health systems based on new technologies and management methods that meet modern conditions.

A new model of the health care system should be created and begin to function in parallel with the existing system, gradually intercepting its functions. Such an approach minimizes the loss of the transition period and will provide the population with quality medical care during the transition period. The new model focuses on preventive medicine and a personalized approach. The creation of a new health care model is based on the development of so-called "digital" medicine, which allows collecting and processing, including remotely, large amounts of data at the population level to

make informed optimal strategic decisions and identify new directions of development” [4].

According to the content of the Program, the implementation of Digital Healthcare should lead to the following:

- citizens are provided with timely, necessary and high-quality medical care using digital medical services by doctors, patients, healthcare managers of all levels and forms of ownership;
- affordable, convenient, efficient and high-quality medical services help to increase the average life expectancy of the population of the Russian Federation to 76 years, increase the active and working age of citizens up to 5-6 years after reaching the retirement age.

The expected results of the implementation of the Digital Healthcare program are:

- 1) Citizens of the Russian Federation will be provided with affordable medical care at the place of demand that meets the criteria for timeliness, personalization, prevention, manufacturability and safety.
- 2) The productivity and efficiency of using material, human, informational and other resources and data in the provision of medical services will be improved (by 2025 by no less than 30%), while maintaining the quality of medical care for all patients in accordance with regulatory documents of the Ministry of Health of Russia .
- 3) An ecosystem of digital health will be created in Russia through the transfer of innovative solutions to medical organizations and the support of domestic start-up companies in this area.

To achieve these goals, it is necessary to create a regulatory environment conducive to the development of digital health, including:

1. The state regulation system formation of digital health.
2. Development of measures system of state support for digital health care, including encouraging the transition of medical organizations to the formation, use and processing of legally relevant electronic medical and organizational documents, the use of digital health services.
3. Ensuring the citizens of the Russian Federation of continuity and quality of medical care by providing medical personnel involved in the process of providing medical care, and the patient access to legally relevant electronic medical information located in the EHR USHIS (subject to the consent of patients to the processing of medical information in electronic form), despite the form of the medical organization ownership providing medical care
4. Procedure determination for providing medical care using registered medical equipment designed to provide medical care using digital health care and interacting with it support systems for making medical decisions.

### *B. Main directions of digital healthcare development*

A person is at the center of the digital economy. New technologies are being introduced precisely for the comfort and convenience of the population. Health care is no exception. In digital medicine, the patient does not go to the doctor's clinic when he has something sick, but the medical officer, seeing deviations in the patient's testimony, contacts him until the patient is sick. Despite this picture now seems somewhat utopian, technical problems for its implementation becomes less every year.

At the center of health in the XXI century there are data - electronic health records (EHR), which digitally collect all data on the state of human health from the moment of his birth. Today, EHRs are already used in 94% of US hospitals. The centralized medical record system should appear in the European Union in 2020. A unified state healthcare system is being created in Russia. At the same time, its local segments exist and successfully operate in many regions of our country today. For example, in Moscow all state city polyclinics are connected to the Unified Medical Information System (UMIS).

Another component of digital medicine is carrying medical sensors that will transmit data online about the physiological body parameters and human activities. Their wide distribution will not only encourage people to lead a healthy lifestyle, but also provide the ability to remotely monitor the health status of patients. In the future, this approach should significantly reduce the number of visitors to medical organizations. In the near future, wearable devices can become not only a means of diagnosing a condition. They will be able to make their own decisions about the need for medical intervention.

Telemedicine will solve the problem of quality and efficiency of medical care, especially for citizens living in places remote from large medical centers, as well as for chronic patients, patients undergoing rehabilitation, and age patients who need constant monitoring. The law on telemedicine, signed in July 2017 [5], introduced changes to a number of legal acts regulating the use of IT-technologies in the health sector, and legally enshrined the concept of "telemedicine technologies" designed to provide remote communication of doctors and patients. With their help, it is also possible to significantly reduce the number of patient visits to the hospital - after all, part of the doctor's recommendations can be obtained without leaving home.

Big data is another technology that can be used both to improve the quality of diagnosis and treatment, and in the development of new drugs. The more widely distributed medical gadgets will receive, the more information will be accumulated in the medical data storage. And its processing opens up truly endless opportunities for healthcare to identify patterns, trends, and develop new treatments.

Artificial Intelligence (AI) in health care can become an indispensable tool to support medical decision making. The most well-known solution in this area — the IBM Watson system — based on analysis of vast data amounts, such as recent scientific advances, expert opinions, and the patient's

medical history, helps the doctor most accurately diagnose and prescribe the optimal treatment. Today, IBM Watson is used in hospitals in Japan, China, the United States, several European countries and, according to statistics, increases the likelihood of making a correct diagnosis by 40% [6].

AI systems are quite widely used in oncology, where they allow us to isolate a tumor and healthy tissues in a medical image, as well as to evaluate how effectively the therapy was carried out on patients. AI also helps to detect a number of diseases in the early stages, such as blood poisoning, for example.

The technologies of virtual and augmented reality have already proven themselves well both in the process of rendering medical aid, for example, in surgery, and in the course of rehabilitating patients after surgery. They also find application in the process of training and professional development of medical workers. Several European hospitals have already begun to test augmented reality glasses. The surgeon who puts them on not only sees the operation, but also receives detailed information about its course, which allows him to correct his actions. And in Switzerland, the Mindmaze – VR solution technology has been developed, which helps restore movement coordination of people who have suffered a stroke.

Robots are increasingly used in healthcare. Hundreds of clinics around the world, including about 20 in Russia, are already performing endoscopic surgery with the help of a robot surgeon Da Vinci. The doctor at the console sees the surgical site in 3D with multiple magnification and uses special joysticks to control the surgical instruments.

In addition, robots can be useful in the training of doctors. There is also a simulation center in the medical cluster of the Skolkovo Innovation Center, where domestic-made robots are presented, where you can learn to fight stroke, laparoscopic and endoscopic operations, gastroscopy, and much more.

3D printing is another technology in the near future that can radically change health care. Printed on the 3D-printer models of the joints, dental implants, etc., as closely as possible correspond to the individual characteristics of each individual patient. Thus, in the British Institute of Regenerative Medicine Wake Forest has successfully grown 30 different types of cells and organs, as well as cartilage and bone, including ears and noses.

Among the technologies that in the near future should fundamentally change medicine, making it "smarter", not to mention the blockchain. Ensuring the availability of medical care is impossible without the widespread use of digital technologies to solve the problems of reference and information support for making medical decisions, including by means of providing rapid access to complete and accurate information about the patient's health, the implementation of automated procedures to verify compliance with the selected treatment standards of medical care, checking the correctness of prescribing drugs, receiving remote medical consultations by persons suffering from chronic diseases, require constant monitoring, operational professional interaction of doctors and pharmacists. Especially all this is relevant, taking into account

the area of the Russian Federation and the distance between individual settlements.

Digitalization of health care, including the improvement of information technology support for the medical and pharmaceutical organizations activities, health workers, students of medical and pharmaceutical universities, should ultimately increase the efficiency of the healthcare management. So today, in Sechenov University, there is training in two specialties in demand for "medicine of the future" - "IT-physician", a network doctor, and scientific research is being conducted in the Russian National Research Medical University named after N.I. Pirogov.

Thus, digital health care should be an essential element in the provision of all types of medical care, be used in outpatient and inpatient settings, in emergency, urgent and planned forms. At the same time, it is necessary to ensure the coherence of the information space by introducing for all medical organizations uniform electronic formats for processing medical information and its confidentiality.

### *C. Experience and problems of implementing projects on the healthcare digitalization in the regions of Russia*

In Russia, the advanced projects in the field of digitalization of the healthcare sector are two information platforms:

- - Unified State Healthcare Information System (USHIS). It will connect the information systems of all medical organizations and specialized departments, will allow to maintain unified electronic medical records and registers of persons with certain diseases. Medical information systems have been already introduced in 83 regions, where electronic health records of 46 million patients are maintained, there is an opportunity for an electronic doctor appointment, etc. This year, in a pilot mode, personal account "My Health" was launched on the portal of public services.

- -The Unified Medical Information and Analytical System of Moscow (UMIAS), which has been operating since 2012. The number of portal users exceeds 9 million patients and 10 thousand medical workers. On the portal, you can make an appointment, get a referral for an examination, issue a sick-list and a medical card. 97% of recipes issued in Moscow are electronic. Moscow is the only metropolis in which all clinics are combined into a single system.

The state develops education and professional retraining, taking into account the digitalization of health care. In 2016 on the basis of the First MSMU named after I.M.Sechenov the country's first Department of information and Internet technologies in medicine was established. It is planned to open similar departments in other universities.

In conditions when digital technologies have become an integral part of radiation radiology, the remote-audit technology has been developed and applied at the Moscow Medical Research Center for Medical Radiology at the Moscow Health Department. Every day, 30 doctors of the highest category look at 10% of all studies conducted on the eve of 77 clinics in the capital. After identifying errors,

individual quality improvement strategies are proposed - educational, technical, organizational. Due to this approach, the quality of diagnostics grows, and, as is known, 30% of success in treatment depends on it.

The Republic of Tatarstan is the foremost subject of the Russian Federation for the provision of electronic services. Accordingly, it has a developed information and communication infrastructure. In Tatarstan, the concept and structure of the digital transformation of the region has been developed. It consists of 10 destinations, including digital geospace, smart city, digital health care and others. In the region, there are 13 high-tech medical care centers which activities have contributed to solving the problems of digital health [7].

In the Volgograd region in the first half of 2018, over 900 thousand residents used the "Appointment to the doctor" Internet-service, and in 2017 this service was used by more than 1.5 million people. The key directions of healthcare informatization development of the Volgograd region will be the creation of a single digital circuit, the expansion of the number of electronic services in the personal account of the patient "My health" on a single public services portal. In order to expand the unified digital circuit this year, 157 medical units will be connected to the Internet at the expense of federal funds - these are district hospitals and medical clinics. The next stage of interaction between medical organizations will be the automation of emergency medical care, increasing its efficiency and obtaining information about the patient in real time. The single digital circuit will unite all polyclinics, feldsher-midwife stations, regional health institutions and leading medical centers in a common system to provide medical care to each patient within the national health system.

Thus, digital health care tools are being implemented in the regions of Russia, but so far this process is slow.

Medicine is one of the most complex branches of the economy, which concerns everyone. So any changes initiated by IT companies are often perceived by the medical professional community with caution. In addition, within the medical community there are differences of opinion regarding the effectiveness of various strategies and methods of diagnosis and treatment.

Therefore, first of all, it is necessary to understand who should lead the process of digitalization – doctors or programmers, and reach an agreement with all participants in the process. In conditions of high competition with Western partners, the development of a common position of all stakeholders and their coming to an agreement will allow Russian IT companies not only to gain a foothold in the domestic market and significantly improve the quality of life in the regions, but also to offer their developments outside the Russian Federation. Digital medicine is one of the few areas with an unusually high export potential.

Another problem is related to the technological factor, namely the insufficient level of integration into a single network and the lack of connections to high-speed Internet networks both among doctors and patients. The connection of all state medical organizations to USHIS is planned for 2025.

At the same time, the implementation of the project to eliminate digital inequality, which involves connecting to the Internet for residents of rural, remote and hard-to-reach areas, is still faced with objective funding difficulties.

#### IV. CONCLUSION

Based on analysis we can draw the following conclusions:

1. Russia is ready to introduce digital technologies in health care, Russia is not the first to follow this path and can import technologies tested by other countries.

2. The question of how quickly digital technologies will penetrate the medical market has become central to the discussion of the digital health program. Optimistic forecast is by 2025. In segments where there is effective demand, primarily in private medicine, this will happen rather quickly. Mass medicine will take this path objectively slowly.

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

- Introduction of electronic medical records.
- Development of the "connected patient" concept –the condition monitoring and medical services provision with the help of embedded intelligent devices.
- Telemedicine.

4. Main advantages of healthcare digitalization are:

- Financial - cost savings by reducing patient contact with doctors and modernizing the organizational delivery system.
- Social - increased availability of quality medical care.
- Professional - improving the quality of services by reducing the number of medical errors, the development of predictive medicine, improving the effectiveness of clinical research.

5. Prospects for the development of digital health are associated with innovation. "Digital healthcare" consortium was established to promote innovative developments in medical institutions in the regions of Russia on the principles of public-private partnership [8]. Large corporations as members of the consortium will act as agents of innovation in regional medical organizations. Transformation of medical institutions in specific regions will be carried out jointly with private business. It will help the state to save money, and investors — to return their investments.

The main directions of healthcare digitalization in Russian Federation are highlighted in the article, the problems and, most importantly, the ways to solve them, will ensure the availability of all types of medical care and activate the processes of wide and rapid introduction of the latest diagnostic and treatment technologies into medical practice.

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