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**DIGITAL HEALTHCARE IN THE RUSSIAN FEDERATION:
SYSTEMS AND TECHNOLOGIES**

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Abstract

Successful modernization of the Russian Federations healthcare system depends on the efficiency of organization processes transformation in healthcare and medicine on the basis of digital platforms. It will allow to provide constant control over expenses for achievement of careful rational expenditure of means, and also the new medical, organizational technologies promoting formation of economy (management of patients streams, telemedicine, providing information support of medical diagnostic processes and medical decisions, geoinformation systems application, systems of processing of medical images). The creation and active use of digital platforms will contribute to the introduction of a model of process management in the healthcare sector, which focuses on the performance of functions by departments and, as a consequence, meeting the needs of citizens. Digital healthcare platforms combine such information resources as laboratory results, electronic patient histories, standards of diagnosis and treatment of patients financial and economic information, databases of medicines, material and labor resources, expert systems, etc. Electronic services allow to use all modern possibilities of collection, storage and processing of information that promotes leveling of the errors connected with time delays of paper document circulation, increase of efficiency of use of working time of doctors, creation of comfortable conditions for interaction with patients.

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1. Introduction

The basic task of modern health care is to ensure a high level of treatment and prevention of the population, which can be achieved through digitalization. Healthcare management as an adaptive digital platform involves a systematic consideration of patient-doctor interactions on the basis of modern technologies that provide not only effective treatment, but also prevention of diseases. This study examines the systems and technologies that are modernizing the health care system and making up the trend of digital medicine.

2. Problem Statement

At present, digital transformation is the leading factor of socio-economic development. Digital transformation is one of the main factors in the development of health care. In public health, digital economy systems and technologies are a major trend and a leading component. For Russian healthcare, digital systems and technologies are the main system-forming factor and are increasingly used. When reforming the Russian health care, the main emphasis is on the use of digital transformations, which will enable the Russian health care to take a leading position in the structure of the country's economic growth. The main burden of Russian health care is that it carries high costs for maintaining the health of people older than 65 years, which are 4-5 times higher than for maintaining the health of people younger than 65 years. The growth of chronic diseases in Russia creates new long-term needs for medical services on the basis of constant interaction with patients, including through the Internet. All this requires the development of new digital platforms and technologies related to the provision of health services, so it is urgent to identify and analyze the main digital technologies and systems that allow for the digital transformation of health care.

3. Research Questions

The Russian medical cluster should ensure the availability of qualified medical services, and the basis for this is digitalization, which ensures close interaction between the doctor and the patient. Important issues considered in the study are new digital medical technologies: telemedicine technologies, "cloud" technologies used to store large information arrays in the big data format (for example, computed tomography or magnetic resonance imaging).

Innovative is the consideration of the use of Internet of things technology in the development of coherent, secure, flexible real-time healthcare systems incorporating Internet of things technology (Chen, Lughofer, & Polikar, 2018). Intelligent healthcare systems that analyze patient data generated from the Internet of things.

We consider a cognitive healthcare system that uses cloud technologies of the Internet of things and allows on the basis of intelligent sensors to monitor the status of patients in real time and provides accurate, timely and high-quality medical services at low cost (Syed Umar, Shamim, & Ghulam, 2019). The issues of using biomedical signals for intelligent mobile healthcare using big data analysis (Jeon, Ahmad, Cuomo, & Wu, 2019).

The issues of automatic monitoring of voice pathology using models for smart medicine are described (Musaed & Ghulam, 2019). The inclusion of health services for older people in smart homes through the Internet of things, contributing to better care for them (Choi, Choi, & Shon, 2019), is reflected.

An evolving 5G network is described that will support intelligent healthcare applications that meet most requirements such as ultra-low latency, high throughput, ultra-high reliability, high density, and high energy efficiency (Abdul, Mohammad, & Kok-Lim Alvin, 2019).

In relation to Russia, the information medical space is considered, including a Single state information system in the field of health care, mobile devices and gadgets that provide monitoring of vital functions, new mobile applications for Android, Windows Modile, etc., designed to expand the scope of user application of personal wearable gadgets.

4. Purpose of the Study

Based on the disclosure of the questions, the aim of the study was formulated: to form technological and platform contours of digital healthcare in Russia on the basis of the main digital platforms and technologies.

The main platform of the digital healthcare circuit in Russia is the unified state information system in the field of healthcare, which provides personalized medical care of all kinds. The main subsystems of the platform: electronic registry, integrated electronic medical record, register of normative and reference information. Electronic registry provides monitoring and management of interaction between patients and medical staff. Integrated electronic medical record allows you to collect, organize and process patient data. The register of normative and reference information provides digital formation and updating of all information in the field of health care. Updating and information interaction of classifiers, reference books, normative information in the field of health care.

The main technologies of the digital circuit are telemedicine and medical artificial intelligence systems. Telemedicine allows on the basis of mobile applications and special services to interact doctor and patient. Thus, the patient will be able to receive qualified care online at any time, while being at home. Artificial intelligence technologies allow to systematize a large amount of medical data on the basis of neural networks

The Samara-Togliatti agglomeration may become a priority platform for the implementation of the digital healthcare circuit. Organizational arrangements for the creation of a digital contour health of Samara-Togliatti agglomeration should include: the establishment of regional interagency project of the center for the selection, pilot testing and implementation of innovative products, development of complex of measures on creation and introduction in practice of health and medical education innovative products on the subject of IT-medicine, using technology, virtual and augmented reality, neurotechnology, artificial intelligence formation of "end-to-end " technologies in the field of digital health care within the framework of the Scientific and technological initiative of Russia.

5. Research Methods

In the study, the calculation of the integral estimates of the level of digitalization of healthcare in the Russian regions was carried out using an iterative method of multivariate belonging to the group of methods of multidimensional comparative analysis. The justification of its use for the construction of rating estimates and multivariate comparative analysis of regional levels of socio-economic development is given in the works of Russian scientists (Tikhomirova & Chaplugin, 2003). The problem of obtaining weight coefficients, as well as the application of the iterative method are described in detail in the work of Tikhomirova (2009).

Multivariate comparative analysis reflects the deterministic state of the region in terms of digitalization of health care and does not take into account the stochastic nature of the processes under consideration. In our opinion, the solution of the two-fold problem of multidimensional comparative analysis taking into account the probabilistic (Parmeter & Kumbhakar, 2014) component of modern mass digitalization processes is possible within the framework of stochastic frontier analysis, the essence of which is the construction of multidimensional nonlinear stochastic models to obtain on their basis aggregated quantitative estimates of the States of the subjects and their subsequent comparison.

Thus, the methods of this class allow to develop nonlinear probabilistic models, to obtain on their basis multidimensional deterministic estimates and to carry out the distribution of subjects to assess their functioning taking into account the deterministic and stochastic component.

6. Findings

Systems and technologies of digital health care are investigated. It is shown that in Russia a single state information system in the field of health care is used as the main platform for digital health care. Based on the analysis of the regional dimension of healthcare digitalization, the following conclusions are made. The region's healthcare information space is platform-independent, the region's cloud-based digital healthcare platform is a technology group that will unite all regional services. Information and technological conditions for transforming regional healthcare into digital are based on the results of monitoring health resources and include big data technologies. The transformation of the quality control system for doctors is carried out through the introduction of information systems for decision support based on the use of intelligent processing and analysis of "big" data. Cloud technologies, intelligent technologies based on big data, telemedicine are considered as the main technologies of smart medicine.

7. Conclusion

Thus, this study identifies global trends in the creation and development of digital healthcare. The issues of using telemedicine technologies, "cloud" technologies for storing large information arrays about patients, developing flexible healthcare systems based on the Internet of things, cognitive healthcare, using smart sensors to track the patient's condition, and mobile systems for monitoring the patient's condition are investigated. Proposals for the development of digital health care in the Samara. It is shown that the transformation of regional healthcare into digital is based on intelligent and cloud technologies.

Togliatti agglomeration are given. Special attention is paid to the unified state information system in the field of health care in Russia.

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