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Zhao Zhenyi

GLOBAL TRENDS IN THE USE OF INFORMATION TECHNOLOGIES IN HEALTHCARE

The article provides a thorough analysis of current global trends in the use of information and communication technologies (ICT) in the activities of healthcare institutions. It is emphasized that the transformation of the forms and methods of work of medical institutions, as well as the development of the types of ICT they use, are closely related to the active efforts of most countries in the direction of digitalization of the healthcare system. The introduction of innovative digital solutions is considered an important element of the state policy of modernization of the medical industry, aimed at increasing the efficiency of management, transparency of processes and accessibility of medical services for the population.

Particular attention is paid to the trend of expanding the target audience when forming communication strategies of medical institutions. It is emphasized that modern medical communication is increasingly focused not only on treatment, but also on the prevention of diseases, the promotion of a healthy lifestyle and the formation of a culture of responsible attitude to one's own health. In this context, state participation in the development of information and education programs for the population, especially among youth and minors, is important, which contributes to the formation of long-term positive trends in the field of public health.

Analysis of foreign experience gives grounds to argue that the acceleration of the implementation of ICT in medical practice is largely due to the impact of the COVID-19 pandemic. It has become a catalyst for global changes in approaches to doctor-patient interaction, highlighting the need for the development of telemedicine, remote health monitoring and electronic document management. In this process, the key role belongs to the state, which creates regulatory, legal, organizational and financial conditions for the integration of digital solutions into national healthcare systems, while ensuring the protection of personal data, equal access of citizens to medical services and sustainable functioning of the industry in times of crisis challenges.

Keywords: *information technologies, information and communication technologies, healthcare, public administration, state regulation, digitalization.*

Statement of the problem in a general form. Today, the relevance of issues related to the identification of the main trends in the use of information and communication technologies (ICT) in the field of healthcare is due to a number of objective factors that determine the development of the modern information society.

Firstly, in the context of globalization, the value, significance and strategic importance of information as a key resource for management and decision-making are significantly increasing. The high level of information saturation of modern society, the increase in the number of sources, tools and communication channels, on the one hand, provide wider access to data, and on the other hand, create risks of information overload, which manifests itself in the phenomenon of «information fatigue». This problem is especially noticeable in the medical field, where an excess of unsystematized information can affect the quality of perception, processing and use of data by both medical professionals and patients.

Secondly, the problem of accessibility and understandability of medical information remains relevant. Medical communication has a specific nature, as it is characterized by a high level of use of professional terminology, which often complicates its perception for a wide audience.

At the same time, there is an insufficient, fragmented level of informatization of processes in the field of healthcare, which creates barriers to effective data exchange between medical institutions, government agencies and citizens. Solving this problem requires the active participation of the state – both in the regulatory regulation of digitalization processes and in providing financial, technical and educational support for the digital transformation of the medical system.

Thirdly, the relevance of the issues under study is due to the need to form universal models for organizing information and communication interaction, as well as standardizing and streamlining digital processes in the medical field. Given the constant expansion of the spectrum of technological tools and communication channels, there is a growing need to create unified standards for the exchange of medical information that will ensure system compatibility and personal data security.

Analysis of current global trends shows that the focus on digitalization of healthcare and the implementation of innovative ICT solutions is a global pattern of development of medical systems. The leading role in this process is played by states that determine strategic directions of digital transformation provide a legislative basis for the implementation of electronic medicine, contribute to the creation of national electronic databases, the development of telemedicine, as well as the formation of a digital culture among medical professionals and patients. It is the coordinated actions of state institutions, the scientific community and the business sector that create the basis for the sustainable development of the digital healthcare ecosystem.

Results and Discussion. Modern challenges in the field of healthcare necessitate a rethinking of approaches to the functioning of medical organizations. They form more complex and multidimensional tasks not only in ensuring the performance of basic professional functions by medical workers, but also in creating a client-oriented environment based on the principles of openness, transparency and a high level of service. In modern conditions, the effectiveness of medical institutions increasingly depends on the ability to form trusting relationships with patients, which, in turn, requires the development of an effective communication infrastructure.

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Ensuring appropriate standards of service and improving the quality of medical care requires the establishment of a constructive dialogue between all participants in the healthcare system – state institutions, medical institutions, the professional community and patients. That is why the search for effective information and communication tools that can ensure not only the operational exchange of data, but also the formation of sustainable, trusting forms of interaction aimed at increasing the accessibility, quality and personalization of medical services is becoming particularly relevant [3].

It has been established that both in developed and developing countries there is a trend towards the creation of a single digital healthcare circuit. This process includes the implementation of electronic medical records, the development of telemedicine, remote monitoring of patient status, digital registries and platforms for the exchange of clinical information. Although the solutions used vary in scale, technological complexity and level of government support, they are all united by a common goal – improving the quality standards of medical care, ensuring equal access of citizens to medical services and increasing the level of patient satisfaction.

Despite the lack of a universal model for organizing the healthcare system, as well as a unified practice for resolving issues of regulatory, legal and methodological support for the development of digital forms of communication, the analysis of international experience allows us to identify the main directions of evolution of practices for the use of information and communication technologies in the medical sphere. An important role in this process is played by state structures that determine the strategy for the digital transformation of the industry, create legislative frameworks for the functioning of electronic services, support the development of e-health infrastructure and stimulate the integration of innovations into the everyday practice of medical organizations [15].

Taking into account the above, we can state that the current stage of development of the healthcare sector is characterized by a transition from local initiatives to a systemic, state-oriented approach to the implementation of information and communication technologies, which not only ensures increased efficiency in industry management, but also forms the basis for sustainable development of public health in general.

Among the leading global trends in the development of the healthcare sector, it is worth highlighting the close relationship between the transformation of approaches, methods and forms of communications and interaction in the medical industry and the strategic course of most modern states towards the digitalization of medical processes. Such changes reflect the general trend of transition to a model of digital transformation of the healthcare sector, within which information and communication technologies (ICT) act not only as a tool for increasing management efficiency, but also as a mechanism for ensuring transparency, accessibility and personalization of medical services. A special role in these processes is played by the state policy of «open innovation», aimed at developing partnerships between the government, scientific institutions, business and civil society [10]. It is this approach that allows creating a favorable environment for the introduction of the latest technologies into the medical sector – from e-health systems to artificial intelligence platforms that help in diagnostics, disease prediction and clinical decision-making (fig. 1).

Fig. 1. Key aspects of the policy of «open innovation» in the field of health care.

Source: formed by the author

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The experience of a number of countries that have achieved significant progress in the field of digital transformation in healthcare is indicative. Existing practice demonstrates that technological modernization of medicine is not only a technical, but also a socio-economic process that requires the active participation of the state, the scientific community, and the business sector (Fig. 1.2).

Thus, China is implementing a large-scale program «Internet + Medicine», which integrates telemedicine services, remote consultations, electronic prescriptions and intelligent medical resource management systems. At the national level, a single digital platform is being created, uniting public and private clinics, pharmaceutical companies, and insurance organizations. For example, such technological giants as «Alibaba Health» and «Ping an Good Doctor» provide online consultations, electronic prescriptions and remote monitoring of patients' health status 24/7. This not only increases the availability of medical services in remote regions, but also reduces the burden on traditional medical institutions [2; 4].

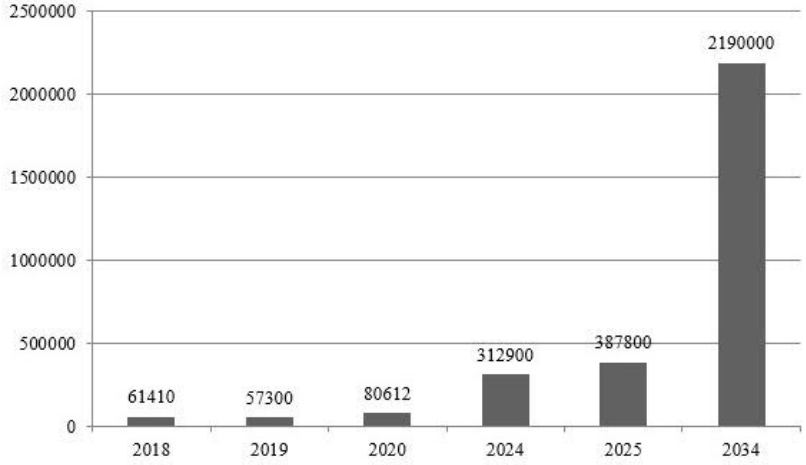

Fig. 2. Dynamics of investments in healthcare digitalization products, in billions of dollars.

Source: formed by the author based on [24]

It is worth mentioning India, which is also trying to actively develop the «National Digital Mission in Healthcare (Ayushman Bharat Digital Mission)», which involves the creation of a single electronic healthcare ecosystem [20]. As part of this initiative, the «Digital Health ID» is being implemented – a personal identification number that provides access to citizens' medical records, their medical histories and recommended appointments. This solution contributes to the transparency of medical processes, reducing the risks of data duplication and ensuring more effective interaction between patients, doctors and relevant government agencies [21].

The Republic of Korea is also one of the world leaders in digital innovation processes in the healthcare sector. The country is among the top 10 in the Global Innovation Index, demonstrating high results in the field of scientific research, development of medical technologies, bioengineering, telemedicine and big data analytics. An example of successful practice is the creation of a national platform «Digital Healthcare Platform», which allows doctors and patients to exchange data in real time. Thanks to this, the Korean healthcare system is distinguished by a high level of digital integration and the effectiveness of responding to crisis situations, in particular during the COVID-19 pandemic [5].

Southeast Asian countries also demonstrate the dynamic development of the digital economy and high-tech sector. In particular, in Vietnam, projects to create electronic health records are actively developing, and in the Philippines, the «eHealth Philippines» program is being implemented, aimed at improving the efficiency of hospital management and forming a national electronic healthcare system [27]. Due to the high export and import rates of technological products, these countries create favorable conditions for the implementation of cloud databases, artificial intelligence systems for diagnostics and online medical consultation services. It is worth noting the increasing trend of the spread of these practices in African countries, which, despite the limited resources available, are actively implementing innovative solutions in the field of healthcare. Here, mobile technologies (mHealth) play a key role, compensating for the shortage of medical institutions and specialists. In Kenya, the mHealth Kenya initiative is operating, which

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provides monitoring of HIV patients using SMS services and mobile applications. In Nigeria, digital malaria surveillance systems have been created that help to record cases of diseases in real time and plan preventive measures. Similar projects are being developed in Uganda and Ghana, where mobile platforms are used to monitor vaccination of children and track the epidemiological situation [13; 17; 19].

Thus, the analysis of world experience convincingly shows that the digitalization of healthcare is a strategic priority for most countries in the world – regardless of their level of economic development. The success of such transformations largely depends on state policy, which determines the legal, organizational and institutional principles for the implementation of innovative technologies. The state acts at the same time as a regulator, investor and guarantor of ethics, security and accessibility of digital solutions, creating conditions for the sustainable development of the medical system in the context of global digital transformation.

It is worth emphasizing that today humanity has accumulated significant experience in the field of building models of organization, management and financial support of the healthcare sector, as well as in finding ways to optimize them in accordance with the socio-economic conditions of society. The evolution of these models reflects the desire of states to achieve a balance between the availability of medical services, the financial sustainability of the system and high standards of quality of medical care [8].

The world's leading countries demonstrate that effective healthcare organization is possible only if public administration, market mechanisms, and the introduction of innovative technologies are combined. For example, countries with developed medical infrastructures – such as the United Kingdom, Sweden, Canada, and the Netherlands – have managed to create systems that provide broad coverage of the population with free or partially subsidized healthcare, financed through taxes or social insurance funds [7].

Such models not only guarantee equal access to basic healthcare services, but also contribute to the rationalization of sources of financial support. For example, in Sweden, a significant part of the financing comes from municipal budgets, which allows taking into account

regional healthcare needs. The Netherlands has a mixed model, where mandatory health insurance is combined with competition between insurance companies, and the state controls tariffs and service standards [8].

Special attention deserves the effective management of medical systems, which involves the implementation of electronic accounting systems, digital registries and analytical monitoring mechanisms. This allows to avoid duplication of costs, prevent irrational use of resources and increase the transparency of the processes of allocation of funds. An example is Canada, where the implementation of a single digital patient database (Canada Health Infoway) provided a significant reduction in administrative costs and increased efficiency of management of hospital networks [18]. Innovations are a key factor in improving the quality and accessibility of medical services. They cover both technological solutions (telemedicine, electronic prescriptions, digital diagnostics) and organizational ones – new management models, partnerships between the state and the private sector, the involvement of artificial intelligence for clinical decision-making support. Indicative in this context is the Global Innovation Index, according to which Switzerland took first place among 129 countries of the world, demonstrating the high efficiency of innovation policy, in particular in the field of health care. The top five also includes Sweden, the United States, the Netherlands, and the United Kingdom. These countries are an example of a systematic approach to stimulating innovation: they provide state support for scientific research, develop startup ecosystems in the field of biomedicine, pharmaceuticals, and digital health [28]. The United States deserves special attention, which is recognized as a world leader in the number and scale of programs to support innovation in medicine. In particular, institutions such as the National Institutes of Health (NIH), Centers for Medicare & Medicaid Services (CMS), and Advanced Research Projects Agency for Health (ARPA-H) implement dozens of initiatives aimed at developing new diagnostic technologies, digital medical platforms, innovative treatment methods, and data management. Thanks to this, the United States forms global standards in the field of biomedical innovation and sets the pace for the development of digital medicine at the international level [9].

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It is worth emphasizing that the existing analysis of the experience of leading countries shows that an effective healthcare sector is based on a combination of stable financing, clear state policy, innovative potential and modern technological solutions. It is the synergy of these factors that ensures the improvement of the quality of medical services, the reduction of social inequality in access to them and the creation of conditions for the sustainable development of the sector.

It is also worth noting the importance of the spread of mobile healthcare (mHealth) – a set of digital solutions based on the use of mobile technologies and designed to support the processes of prevention, diagnosis, treatment and monitoring of health. Such solutions are actively used by both medical professionals and patients, providing a new level of interactive interaction in the healthcare sector [16].

The basis of mHealth is the use of mobile communications, smartphones, wearable devices – smart watches, fitness bracelets, sensors, etc., which collect, transmit and analyze data on the user's body condition. This creates the possibility of remote monitoring of patients, monitoring of vital signs (pulse, blood pressure, glucose level, blood oxygen saturation, etc.) and timely response to any deviations [23].

From a practical point of view, mobile healthcare is most often implemented in the form of specialized mobile applications or integrated platforms that can be synchronized with medical information systems. For example, Apple Health, Google Fit or Samsung Health applications allow users not only to track physical activity, sleep and nutrition, but also to transfer this data to a doctor for further analysis. Other systems, such as MySugr or Glucose Buddy, specialize in controlling blood sugar levels in diabetic patients, while KardiaMobile and AliveCor are used for self-registration of electrocardiograms (ECG) and detection of arrhythmias.

A particularly important area of mHealth development is the monitoring of chronic diseases. In patients with cardiovascular, endocrine or respiratory disorders, mobile applications provide continuous data collection, which allows the doctor to assess the effectiveness of treatment in real time, timely detect complications and prevent the development of acute conditions. For example, in the USA, the Omada Health system is

actively used, which helps people at risk of type 2 diabetes control their weight, activity level and adherence to therapy [31]. It is worth noting that mHealth also has significant social significance, as it contributes to expanding access to health services for residents of remote or low-income regions. The use of mobile technologies allows for affordable, convenient and personalized health care, especially in countries with underdeveloped medical infrastructure. For example, in Kenya, Nigeria and Tanzania, mobile services are already operating that provide patient consultation via SMS or applications, reminders about taking medication and monitoring vaccinations of children [1].

In general, the development of mobile healthcare is one of the key areas of digital transformation of medicine, which combines information technologies, big data analytics and personalized medicine. The implementation of such solutions not only improves the quality of life of patients, but also contributes to a more rational use of healthcare system resources, ensuring timely prevention and more effective treatment.

Among the leading global trends in healthcare today, the creation of open innovation platforms and digital ecosystems focused on using patient health data to improve the efficiency of medical services is also highlighted. Such platforms allow integrating various sources of information, providing doctors with access to up-to-date data and stimulating the development of innovative solutions in the field of medicine.

In the European Union, all member states currently use two key electronic cross-border health services:

1. Digital Patient Summary – a concise list of basic health information, including surgeries, chronic and other diseases, prescribed medications, allergies and other critical data. This information is integrated into a large database of electronic health records (Electronic Health Record). This approach allows doctors to obtain the necessary data about the patient, even if he is in another EU country and there is a language barrier, which is especially important in the case of emergency care [14].

2. Electronic prescription (ePrescription / eDispensation) – a system that allows EU citizens to receive medications prescribed by a doctor in pharmacies in any EU country. The prescription is transmitted

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online from the patient's country of residence to the host country, which ensures continuity of treatment and convenience for patients traveling or temporarily residing abroad [26].

The implementation of these services ensures the exchange of medical information between doctors in different countries, forming a new infrastructure of digital services and opening up opportunities for the integration of additional data. As of 2025, it is planned to expand the exchange of medical information in 25 EU countries, including hospital discharges, laboratory test results, medical images, electronic documents and electronic patient health records [11].

At the same time, the degree of implementation of eHealth technologies in different European countries remains uneven, which creates additional difficulties for the standardization and integration of digital health services. For example, in Germany and Sweden, the implementation of electronic prescriptions and integrated health records is taking place faster than in some Eastern European countries, where the eHealth infrastructure is still being formed [30].

Thus, the development of cross-border electronic health services demonstrates the important role of the state and regional organizations in ensuring safe, accessible and effective exchange of medical information, improving the quality of medical services and integrating innovative technologies into healthcare.

Analyzing global trends in the use of information and communication technologies in healthcare institutions, it is necessary to emphasize the significant influence of external factors on the speed and efficiency of adaptation of new technological solutions. In particular, the intensification of the process of implementing modern information systems was largely stimulated by the COVID-19 pandemic, which significantly changed approaches to organizing interaction between a doctor and a patient, forcing medical institutions to switch to remote consultations, telemedicine and integrated digital services.

Unified Communications as a Service (UCaaS) solutions have become particularly popular since the beginning of the pandemic. These systems are a set of applications that allow healthcare organizations to communicate effectively over IP networks and integrate all communica-

tion channels on a single platform [12]. Depending on the provider and the specific needs of the institution, the UCaaS configuration may vary, but typical solutions include:

– a hosted telephone system for voice calls,
– network management and communication monitoring tools,
– video conferencing and online meeting tools,
– platforms for collaboration and document exchange,
– contact centers and management portals for coordinating patient requests [29].

The use of UCaaS allows healthcare institutions to increase the efficiency of interaction between doctors, patients, and administrative staff, optimize internal processes, and ensure the continuity of medical care, even in emergency situations [32]. This trend demonstrates that digital communication platforms are becoming a key tool for transforming healthcare, setting new standards for accessibility, quality and safety of healthcare services.

It is impossible to ignore the fact that innovative healthcare technologies are being actively developed and implemented in China. In particular, the country has created one of the world's largest epidemiological surveillance systems, which provides online transmission of data on the state of public health and allows for rapid tracking of the spread of infectious diseases.

In addition, an online prescription system is being actively implemented, which allows avoiding a monopoly on the sale of medicines, making pharmaceutical services more accessible and transparent. In this context, it is worth highlighting the mobile applications «Alijk», which are part of the functionality of the Chinese Center for Mobile Medical Innovation. These platforms allow patients to upload scans of prescriptions, receive information about the cost of medicines in the nearest pharmacies, pay for purchases via the mobile payment system «AliPay» and deliver medicines to their homes. Thanks to this technology, purchasing medicines has become easier and more economical – savings can reach up to 50% [22].

An important example of commercialization and scaling of medical innovations is the company Chunyu Yisheng, which specializes in the

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development of medical mobile applications. It has launched more than 300 clinics in 50 cities in China, including Beijing, Wuhan, Hangzhou and Shanghai. The clinics operate on the basis of existing medical institutions and provide both traditional medical services and remote consultations via the Internet. Today, Chunyu Yisheng has employed more than 100 thousand doctors, and the number of patients served through the system reaches approximately 58 million people [25].

The organization of the telemedicine business in China is also engaged in the insurance company Ping An, which provides remote consultations with the participation of 50 thousand doctors and serves more than 77 million users. The mass use of telemedicine services is provided by the Spring Rain Doctor mobile application, through which millions of Chinese residents can receive a doctor's consultation by phone or via SMS [6].

Thus, the Chinese experience demonstrates the comprehensive application of innovative digital solutions that cover both epidemiological data management and patient access to medical services via mobile platforms, providing a significant increase in the efficiency and accessibility of healthcare [22].

Today, there is a noticeable increase in interest in scientific research in the field of information and communication technologies, which is due to the significant potential of electronic health (eHealth). These technologies have the ability to significantly increase the accessibility of medical services and improve their quality in the short term by integrating modern digital solutions into healthcare practice. The implementation of innovative potential in this area can be much more effective if advanced international models of stimulating the development of medical innovations are adapted to national characteristics and socio-economic context. This approach will allow for the formation of a more integrated, technologically advanced, and patient-centered healthcare system capable of meeting modern challenges, increasing the efficiency of medical care, and promoting the sustainable development of the industry.

Conclusion. The expansion of the digital contour of the healthcare sector has become a global trend. At the same time, information and communication technologies used in different countries differ significantly

in their nature, scale and scope of use, but their common goal remains unchanged – increasing the accessibility, quality of medical services and patient satisfaction. Analysis of foreign experience in implementing ICT in the activities of healthcare institutions has allowed us to identify key trends and patterns in the development of digital medicine.

The study shows that the formation of a single digital healthcare contour is closely related to the transformation of approaches, forms and methods of communication between the medical community and patients, as well as to state policy aimed at supporting innovation. In particular, an analysis of Asian and European experience indicates a correlation between the speed and depth of ICT development in healthcare and the position of countries in the global innovation efficiency rating compiled according to the Global Innovation Index.

The study of the structure of key ICT solutions also demonstrates the close relationship between their implementation and political decisions regarding the large-scale digitalization of the healthcare sector, the implementation of an open innovation policy and the digital transformation of the specified sphere. The center of the formation of the communicative environment is increasingly becoming innovative ecosystems based on patient health data. The main concept of such approaches is the development of eHealth – digital medicine, which integrates modern ICT into healthcare practice.

The modern focus of the medical community is shifting from exclusively medical activities to issues of disease prevention and the formation of a healthy lifestyle. This determines new standards for the use of ICT, in particular, active interaction through modern social and digital communication channels focused on the younger generation. In addition, the experience of foreign countries demonstrates that the intensification of the processes of implementing innovative medical solutions is largely due to the COVID-19 pandemic, which has changed traditional ideas about the forms of interaction between a doctor and a patient. As a result, telemedicine technologies have been actively developing, including remote diagnostics and comprehensive solutions for forming a «digital portrait» of the patient and medical institutions.

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ГЛОБАЛЬНІ ТЕНДЕНЦІЇ ВИКОРИСТАННЯ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ В СФЕРІ ОХОРОНИ ЗДОРОВ'Я

У статті здійснено ґрунтовний аналіз сучасних світових тенденцій використання інформаційно-комунікаційних технологій (ІКТ) у діяльності закладів охорони здоров'я. Підкреслюється, що трансформація форм і методів роботи медичних установ, а також розвиток типів ІКТ, які вони застосовують, тісно пов'язані з активними зусиллями більшості держав у напрямі цифровізації системи охорони здоров'я. Впровадження інноваційних цифрових рішень розглядається як важливий елемент державної політики модернізації медичної галузі, спрямованої на підвищення ефективності управління, прозорості процесів та доступності медичних послуг для населення.

Особливу увагу приділено тенденції розширення цільової аудиторії під час формування комунікаційних стратегій медичних установ. Наголошено, що сучасна медична комунікація дедалі більше фокусується не лише на лікуванні, але й на профілактиці захворювань, популяризації здорового способу життя та формуванні культури відповідального ставлення до власного здоров'я. У цьому контексті важливою є державна участь у розробці програм інформування та просвіти населення, особливо серед молоді та неповнолітніх, що сприяє формуванню довгострокових позитивних тенденцій у сфері громадського здоров'я.

Аналіз зарубіжного досвіду дає підстави стверджувати, що прискорення впровадження ІКТ у медичну практику значною мірою зумовлене впливом пандемії COVID-19. Вона стала каталізатором глобальних змін у підходах до взаємодії лікаря та пацієнта, актуалізувавши потребу у розвитку телемедицини, дистанційного моніторингу стану здоров'я та електронного документообігу. У цьому процесі ключова роль належить державі, яка створює нормативно-правові, організаційні та фінансові умови для інтеграції цифрових рішень у національні системи охорони здоров'я, забезпечуючи при цьому захист персональних даних, рівний доступ громадян до медичних послуг і стале функціонування галузі в умовах кризових викликів.

Ключові слова: *інформаційні технології, інформаційно-комунікаційні технології, сфера охорони здоров'я, публічне управління; державне регулювання, цифровізація.*

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Відомості про автора / Information about the Author

Чжао Чженьї, аспірант кафедри публічного управління та адміністрування, Юридичного факультету, Чорноморського національного університету імені Петра Могили, Миколаїв – Пекін, Україна – Китай. E-mail: 46542035@qq.com, orcid: https://orcid.org/0009-0006-7030-2479.

Zhao Zhenyi, PhD-student of the Department of Public Management and Administration, Faculty of Law, Petro Mohyla Black Sea National University, Mykolaiv – Beijing, Ukraine – China. E-mail: 46542035@qq.com, orcid: https://orcid.org/0009-0006-7030-2479.

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