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## BACKGROUND AND CURRENT STATE OF DEVELOPMENT OF DIGITALIZATION OF HEALTH CARE IN THE REPUBLIC OF KAZAKHSTAN

**Annotation:** This article examines the current status of digitalization of healthcare in the Republic of Kazakhstan. The influence of digital transformation in medical services on healthcare is considerable and is expected to grow even more in the coming years. Ideally, decisions regarding the implementation and use of new digital health services at various levels of the healthcare system should be based on evidence of their effectiveness, aligned with the healthcare system's objectives. Evaluating the effectiveness of digitalization and identifying areas for its enhancement offers significant opportunities for strategic management in the sector. It also enables ongoing monitoring and analysis of both internal resources (such as human, material, and intellectual) and external factors, allowing for informed management and healthcare decisions.

The article's aim is to investigate the progress of healthcare digitalization in Kazakhstan.

The research draws on the works of both local and international scholars in the fields of the digital economy and healthcare digitalization. Additionally, it utilizes legislative and regulatory documents related to healthcare in Kazakhstan, official publications, statistical reports from the Ministry of Health, and the national healthcare programs, strategies, and concepts. Throughout the study, general scientific methods such as analysis, synthesis, and comparison were employed.

**Keywords:** Health care, digitalization of health care, public services, information systems, digital technologies.

### INTRODUCTION

The effective implementation of digitalization in healthcare contributes to improving the quality of life and the development of accessible, high-quality healthcare services that meet the needs of society, the healthcare market, and individual patients. The use of digital technologies enables faster, more efficient, and timely interactions with patients, while minimizing delays. In the context of the post-pandemic world, the adoption of these technologies also plays a crucial role in reducing the transmission of various viruses.

MedTech (the technological development of the healthcare system) is one of the three key focus areas outlined in the Concept of Digital Transformation, Information and Communication Technology Industry Development, and Cybersecurity for the period 2023-2029 [1].

Currently, healthcare digitalization is also addressed in national initiatives, such as the "Technological Breakthrough through Digitalization, Science, and Innovation" project and the "Concept for the Development of Healthcare in the Republic of Kazakhstan until 2026" [2, 3].

As a result, the relevance of this topic is underscored by the ongoing rapid digitalization across various sectors, including healthcare.

The aim of this study is to analyze the present state of healthcare digitalization development in the Republic of Kazakhstan.

## LITERATURE REVIEW

The digital transformation of healthcare is increasingly important not only for governments, healthcare professionals, and patients but also for researchers. International studies in this field can be categorized into several key areas: patient-centered research, organizational and managerial importance, and socio-economic factors.

The concept of healthcare digitalization, defined as the application of information technology to process and manage data, information, and processes, gained traction in the early 2000s [4]. However, consistent growth in interest in this research area has been observed since 2015, with the peak occurring in 2019 [5].

Among Kazakhstani scholars, the following individuals are actively engaged in the field of digitalization: A.A. Alimbayev, Z.A. Arynova, R.A. Baizholova, A.A. Kireeva, S.T. Ziyadin, A.K. Kurmangalieva, M.U. Baeshova, D.Sh. Ismailova, A.T. Aubakirova, G.K. Kurmanova, B.B. Sukhanberdina, A.O. Sarsenova, and others.

A review of existing studies reveals that they primarily rely on qualitative research, often focusing on hospitals as the main healthcare institutions and on patients. While the effectiveness of healthcare digitalization is generally discussed in terms of consumers and providers, the broader economic and social impacts at the national level are only briefly touched upon. This gap in the literature highlights the academic relevance of our research topic.

## MATERIALS AND METHODS

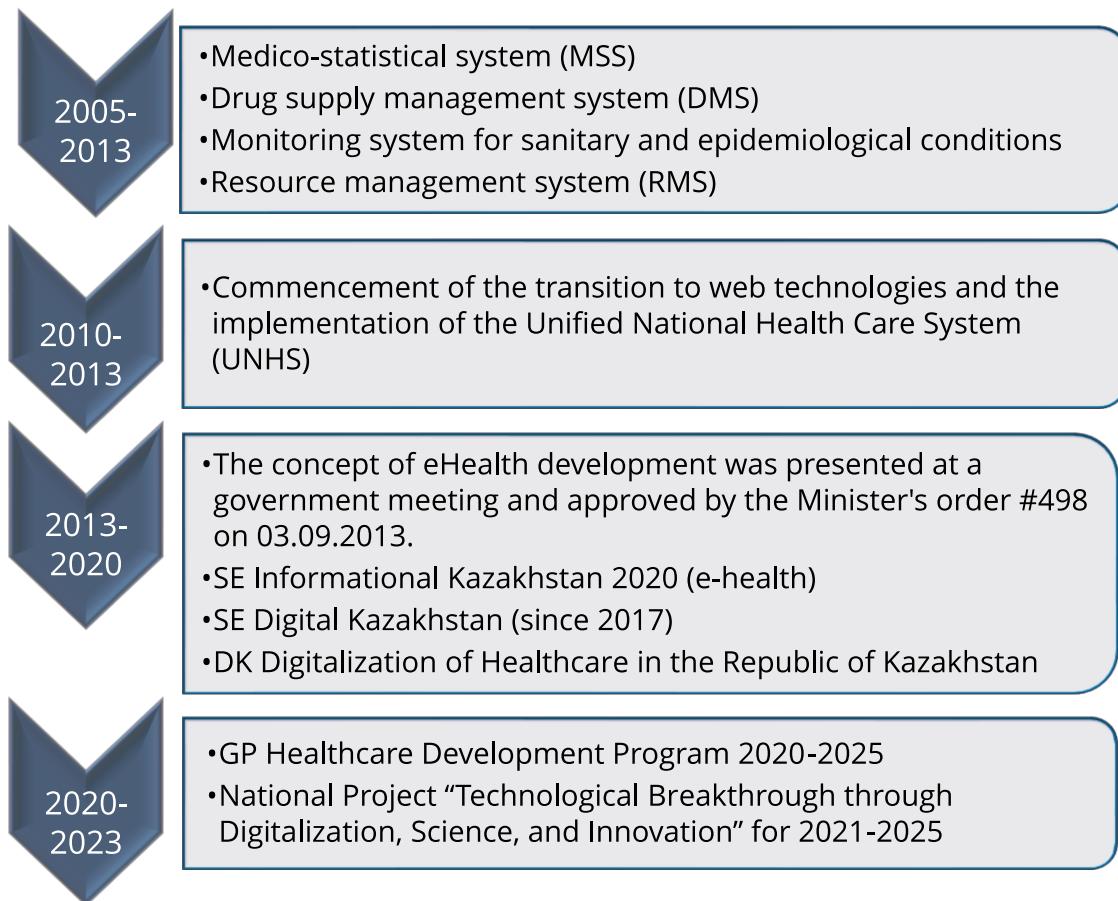
In this scientific article, the authors employed general scientific methods of economic analysis. The methods of systematization and generalization were applied to conduct a chronological examination of the development of the healthcare system in the Republic of Kazakhstan. Additionally, statistical analysis and comparative methods were utilized to assess the trends and transformations within the healthcare services sector of the Republic of Kazakhstan.

## RESULTS AND DISCUSSION

The use of information and communication technologies (ICT) in healthcare began several decades ago, but it was only after 2000 that the active integration of technology started. According to the World Health Organization (WHO), e-health refers to the application of ICT not only within the healthcare system but also in areas such as public health, health management, finance, education, and scientific research related to healthcare [6].

In the early 2000s, Kazakhstan began investing significant funds into healthcare, focusing primarily on preventive health screenings for schoolchildren and rural populations, as well as the purchase of free medications. At that time, there was a growing need for software products capable of accurately tracking and calculating financial flows. As a result, software solutions were introduced to monitor the specific populations and healthcare services covered by these financial allocations. This led to the development of systems such as AIS-diabetes, AIS-hepatitis, and AIS-preventive examinations.

The software implemented during this period often mirrored the work of healthcare professionals. Starting in 2005, Kazakhstan began to make substantial changes in the healthcare sector with the goal of improving the quality of medical services. At that point, the primary focus was on informatization. Figure 1 outlines the sequential introduction of information systems and government programs between 2005 and 2023.



**Figure 1. Stages of development of health information systems in the Republic of Kazakhstan from 2005-2023**

*Note - Compiled by the author on the basis of sources [2; 3; 4; 7-11]*

When information systems were first introduced, information technology represented the potential and possibilities of significant changes. However, the actual implementation of these new technologies had a limited impact, primarily serving to store various types of medical information. At that stage, digitalization mainly focused on processes related to service providers, particularly those necessary for financing and generating reports.

In 2012, as part of a World Bank project, an assessment of the design and efficiency of the information systems within the Ministry of Health and Social Development (MHSD) of Kazakhstan was conducted, involving international experts from the Swiss Tropical and Public Health Institute. The evaluation identified both strengths and weaknesses in the systems [8].

The strengths included:

- The availability of portal solutions deployed across Kazakhstan
- A broad range of functionalities
- A wealth of information stored in databases
- Adequate levels of information security

The weaknesses identified were:

1. Existing information systems were not fully integrated with each other.
2. The systems did not fully meet the daily needs of users and were inconvenient for both patients and healthcare providers.

Based on the findings of this assessment, the Concept of eHealth Development for Kazakhstan from 2013 to 2020 was created.

Since 2013, a new phase of digitalization began, with a greater focus on the service recipient, i.e., the patient, and the digitalization of processes aimed at addressing the needs of the population.

To address the weaknesses identified and enhance Kazakhstan's health information systems, it was planned to introduce the Healthcare Interoperability Platform. This platform was intended to be a core component of the new eHealth architecture, ensuring continuity of care, facilitating the automatic analysis of large volumes of data, and enabling more efficient interactions with patients.

The remoteness and inaccessibility of certain regions make it especially challenging to provide high-quality healthcare to the population.

One of the main issues faced by remote regions is a shortage of qualified medical professionals. Healthcare workers trained in urban areas are often reluctant to work in these areas due to limited professional development opportunities and other social factors.

For some residents, traveling to the nearest medical facility can take several hours or even days, which heightens the risk to life in emergency situations.

To address the challenge of remote and inaccessible regions, the National Telemedicine Network was established alongside the informatization programs in Kazakhstan [12]. This network has been operational since 2004 and, by 2022, included over 247 medical institutions. In 2022, a total of 5,729,758 remote medical services, including telemedicine consultations, were provided to the population. As of the first half of 2022, 12,257 telemedicine consultations were conducted. The highest demand was for consultations in functional diagnostics (2,314 sessions, 18.8% of total consultations), obstetrics and gynecology (1,033 sessions, 8.4%), cardiology (1,038 sessions, 8.4%), and neurology (994 sessions, 8.1%). Between 2004 and 2023, over 133,000 telemedicine consultations were provided to patients by medical organizations [13].

The term "e-health" was first introduced in 2013 in the State Program "Informational Kazakhstan-2020," which was adopted in parallel. In 2017, within the framework of the "Digital Kazakhstan" program, a roadmap for the "Digitalization of the Healthcare System" project was developed, which outlined the gradual introduction of electronic health passports and outreach efforts across Kazakhstan [14].

The primary goal of healthcare digitalization, as defined by this program, is to improve the quality of medical services, reduce queues, and eliminate bureaucracy. On October 5, 2018, during his Address, Kazakhstan's first President N. A. Nazarbayev stated that from January 1, 2019, all polyclinics and hospitals were to transition to paperless digital medical records [15].

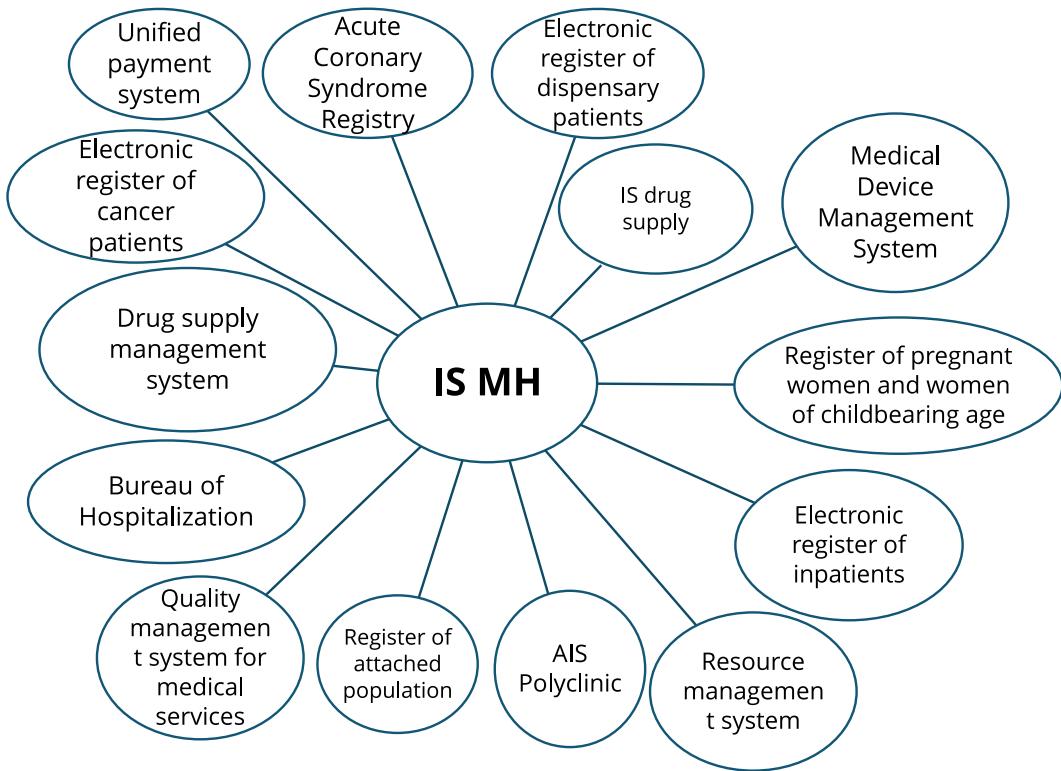
The shift to digital medical records and the adoption of new technologies in healthcare led to significant benefits, such as simplifying processes and saving time. Previously, healthcare institutions had to complete, manage, and archive around 400 forms of accounting and reporting documentation. Now, the majority of this work is handled through electronic document management systems.

By the first quarter of 2023, 49 public services in the healthcare sector were offered in different formats:

- 4 (8.2%) in paper form
- 21 (42.8%) in electronic/paper form
- 24 (49%) in electronic form

The degree of automation of public services in the Ministry of Health was 91.8%, with 45 public services fully automated. Research indicates that, by 2019, over 94% of all healthcare facilities were computer-based. In urban areas, more than 65% of facilities had stable internet access. A significant achievement was the establishment of Medical Information Systems (MIS), which are now in use at over 65% of all medical institutions [16].

Currently, more than 14 integral and stable medical information systems are operational across Kazakhstan, improving the control and management of citizens' health. The creation of electronic medical passports, with more than 16 million records, has become a common practice (Figure 2).



**Figure 2. List of information systems of the MH RK**

Note - Compiled by the author based on source [17]

These software systems facilitate the collection of data in line with established accounting and reporting standards and are utilized across various regions of Kazakhstan. These programs enable the thorough collection of all relevant patient information, which can be leveraged for future use.

**Table 1. Structure of health care expenditures in 2017-2021 (in billion tenge)**

Types of expenses	2017	2018	2019	2020	2021
total health expenditure (THE)	1,759.0	1,885.4	2,056.4	2,829.8	3,269.2
THI as a % of GDP	3.2	3.0	3.0	4.0	4.0
Current health expenditure (CHE)	1,656.1	1,765.7	1,940.2	2,677.7	3,113.8
CHE as % of GDP	3.1	2.9	2.8	3.8	3.8
State expenditures.	1,024	1,086.2	1,163.3	1,770.9	2,012
Public expenditures as % of GDP	1.9	1.8	1.7	2.5	2.5
Private expenditures.	626.9	679.5	776.5	905.8	1,101.8
Private expenditures as % of GDP	1.2	1.1	1.1	1.3	1.3

Примечание – Составлено по источнику [18]

According to Table 1, total health expenditures (THE) in 2021 amounted to 3,269.2 billion, reflecting a 15% increase from the previous year (2,829.8 billion). Current healthcare expenditures (CHE), excluding capital expenditures, totaled 3,112.3 billion tenge.

The proportion of healthcare spending relative to GDP in Kazakhstan was approximately 3-4%, which is lower than in many developed nations, where this figure can reach 8-12% or more. For instance, in the United States, healthcare expenditures account for more than 17% of GDP, while in several European countries, the share ranges from 10-11%.

Despite the lower percentage of healthcare spending in Kazakhstan compared to some other nations, the government is actively working to modernize the healthcare system, implement new technologies, and enhance the quality of medical services for the population.

By the end of 2022, as part of the ongoing healthcare digitalization efforts, medical information systems were introduced, and all healthcare organizations in urban areas and district centers were provided with 100% internet access. In remote rural areas and regions below district centers, internet access coverage was 86.7% [18].

Currently, the continuation of the State Program "Digital Kazakhstan" was approved by the decree of October 12, 2021, under the national project "Technological Breakthrough through Digitalization, Science, and Innovation" for 2021-2025, which includes healthcare digitalization as one of its objectives [3].

Digital technologies enhance the efficiency of services and processes, improving quality and reducing time spent, offering numerous advantages to stakeholders at all levels of healthcare, including the Ministry of Health, healthcare professionals, and patients.

The scientific novelty of this study lies in a comprehensive assessment of the stages and characteristics of healthcare digitalization in Kazakhstan, with a particular focus on institutional, infrastructural, and regional dimensions. In contrast to most previous studies, which have predominantly concentrated on isolated aspects of digitalization—such as the implementation of electronic medical records or the development of telemedicine—this article offers a systemic approach to analyzing the digital transformation of the healthcare sector, including:

- a retrospective analysis of digitalization phases from the early 2000s to the present.
- a structured overview of key governmental initiatives, including programs such as Digital Kazakhstan, Informational Kazakhstan-2020, and the national e-Health and telemedicine development concepts.
- a comparative assessment of healthcare expenditures and digitalization levels across different regions and types of medical institutions.
- the identification of insufficient integration among information systems and the implications of this fragmentation for end users.

A further innovative aspect of the study is the use of dynamic statistical indicators to evaluate the effectiveness of digital services (e.g., the degree of public service automation, the volume of telemedicine consultations, internet coverage, and the implementation of Medical Information Systems, MIS). This approach has made it possible to assess the impact of digitalization not only on healthcare service delivery but also on the quality of governance within the healthcare system.

Thus, the results of this study contribute to the academic discourse on digital transformation in post-Soviet healthcare systems, offering evidence-based guidelines for further sectoral digitalization in contexts characterized by resource constraints and the need to improve healthcare access in rural areas.

## CONCLUSION

The analysis of healthcare digitalization in Kazakhstan indicates that 49 public services are now offered in various formats within the healthcare sector:

- 4 (8.2%) in paper form
- 21 (42.8%) in electronic/paper form
- 24 (49%) in electronic form

The degree of automation for public services within the Ministry stands at 91.8%, with 45 automated public services in total. Research from 2019 shows that more than 94% of healthcare facilities were already using computerized systems. In urban areas, over 65% of facilities had stable internet access. A major achievement has been the establishment and widespread implementation of Medical Information Systems (MIS), which are now in use in more than 65% of healthcare institutions.

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## ПРЕДПОСЫЛКИ И СОВРЕМЕННОЕ СОСТОЯНИЕ РАЗВИТИЯ ЦИФРОВИЗАЦИИ ЗДРАВООХРАНЕНИЯ В РЕСПУБЛИКЕ КАЗАХСТАН

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**Аннотация:** В статье проведен анализ современного состояния развития цифровизации здравоохранения в Республике Казахстан. Влияние цифровизации медицинских услуг на здравоохранение очень значительное, и ожидается, что оно будет еще более глубоким в будущем. Решения о внедрении и использовании новых цифровых медицинских услуг на разных уровнях системы здравоохранения в идеале основаны на фактических данных относительно их эффективности в свете целей системы здравоохранения. Оценка эффективности цифровизации и проблемы ее повышения дают большие возможности в стратегическом управлении отраслью, может обеспечить непрерывный мониторинг и анализ своих внутренних ресурсов (материальных, человеческих, интеллектуальных и др.) и внешних возможностей и угроз, для принятия правильных как управленческих, так и медицинских решений.

Цель научной статьи заключается в проведении анализа развития цифровизации здравоохранения в Республике Казахстан.

Методологическую базу составили научные труды зарубежных и отечественных ученых в области цифровой экономики и цифровизации здравоохранения. В ходе выполнения работы были использованы законодательные и нормативно-правовые акты в сфере здравоохранения РК, официальные издания, аналитические и статистические сборники Министерства здравоохранения Республики Казахстан, изучены государственные программы, концепции и стратегии развития здравоохранения Республики Казахстан.

В период исследования были использованы такие общенаучные методы, как анализ, синтез, сравнение.

**Ключевые слова:** здравоохранение, цифровизация здравоохранения, государственные услуги, информационные системы, цифровые технологии.

## ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДА ДЕНСАУЛЫҚ САҚТАУДЫ ЦИФРЛАНДЫРУДЫҢ ДАМУ АЛҒЫШТАРЫ ЖӘНЕ ҚАЗІРГІ ЖАҒДАЙЫ

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**Андатпа.** Мақалада Қазақстан Республикасындағы денсаулық сақтауды цифрландырудың қазіргі даму жағдайы талданады. Медициналық қызметтерді цифрландырудың денсаулық сақтау саласына әсері өте маңызды және болашақта одан да тереңірек болады деп күтілуде. Денсаулық сақтау жүйесінің әртүрлі деңгейлерінде жаңа цифрлық денсаулық сақтау қызметтерін енгізу және пайдалану туралы шешімдер денсаулық сақтау жүйесінің мақсаттары тұрғысынан олардың тиімділігіне қатысты дәлелдерге негізделген. Цифрландырудың тиімділігін және оны жетілдіру мәселелерін бағалау саланы стратегиялық басқаруда үлкен мүмкіндіктер береді, оның ішкі ресурстарын (материалдық, адами, зияткерлік және т.б.) және сыртқы мүмкіндіктер мен қауіп-қатерлерді үздіксіз бақылау мен талдауды қамтамасыз ете алады.

Ғылыми мақаланың мақсаты – Қазақстан Республикасындағы денсаулық сақтау саласын цифрландырудың дамуын талдау.

Әдістемелік базаны цифрлық экономика және денсаулық сақтауды цифрландыру саласындағы шетелдік және отандық ғалымдардың ғылыми еңбектері құрады. Жұмыс барысында Қазақстан Республикасының денсаулық сақтау саласындағы заңнамалық және нормативтік актілері, ресми басылымдар, Қазақстан Республикасы Денсаулық сақтау министрлігінің талдамалық және статистикалық жинақтары, денсаулық сақтау саласындағы мемлекеттік бағдарламалар, тұжырымдамалар мен стратегиялар пайдаланылды. Қазақстан Республикасының денсаулық сақтау саласының дамуы зерттелді.

Зерттеу кезеңінде талдау, синтез, салыстыру сияқты жалпы ғылыми әдістер қолданылды.

**Түйін сөздер:** денсаулық сақтау, денсаулық сақтауды цифрландыру, мемлекеттік қызметтер, ақпараттық жүйелер, цифрлық технологиялар.