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ECONOMIC ANALYSIS OF DIGITAL HEALTHCARE DEVELOPMENT IN THE EAST KAZAKHSTAN REGION

[1]A. Maldynova, [2]N. Aidargaliyeva, [3]D. Mussabalina, [4]Zh.S. Abdrakhmanova, [5]T. Demesinov

[1]Kenzhegali Sagadiyev University of International Business, Almaty, Kazakhstan,
[2]L.N. Gumilyov Eurasian National University, Astana, Kazakhstan,
[3]Abai Kazakh National Pedagogical University, Almaty, Kazakhstan,
[4]D.Serikbayev East Kazakhstan Technical University, Ust-Kamenogorsk, Kazakhstan,
[5]Sh. Ualikhanov Kokshetau University, Kokshetau, Kazakhstan

Corresponding author: maldynova.a@uib.kz

The digitalization of healthcare is becoming a crucial factor in improving the efficiency and accessibility of medical services worldwide. In Kazakhstan, the level of digital transformation remains uneven across regions. This research focuses on the East Kazakhstan Region, aiming to evaluate the impact of digitalization on healthcare services and identify the relationship between ICT integration and key demographic indicators.

The research is based on statistical data from the Bureau of National Statistics of Kazakhstan, Ministry of Healthcare reports, and international sources covering the period 2020–2024. Methods applied include comparative and statistical analysis, trend modeling, and geographical contextualization with emphasis on regional healthcare infrastructure in Ust-Kamenogorsk.

The research revealed a positive correlation between the increase in ICT specialists and improvements in mortality indicators, particularly maternal mortality. Results demonstrate a twofold increase in computer literacy among healthcare employees, significant growth in internet usage for professional tasks, and progressive but uneven adoption of ICT across healthcare institutions. Despite positive dynamics, challenges persist: insufficient funding for ICT, shortage of cybersecurity specialists, and limited training opportunities.

The novelty of this research lies in its regional focus: it is the first systematic analysis of healthcare digitalization in the East Kazakhstan Region. The findings extend existing theoretical frameworks by incorporating regional heterogeneity and provide practical insights for policymakers to enhance digital healthcare strategies in Kazakhstan.

Keywords: economics, economics of medical services, e-health, socio-economic development, digitalization, information and communication technologies.

ШЫҒЫС ҚАЗАҚСТАН ОБЛЫСЫНДАҒЫ ЦИФРЛЫҚ ДЕНСАУЛЫҚ САҚТАУДЫҢ ДАМУЫНЫҢ ЭКОНОМИКАЛЫҚ ТАЛДАУЫ

[1]А.В. Малдынова, [2]Н. Айдарғалиева, [3]Д. Мұсабалина, [4]Ж.С. Әбдрахманова, [5]Т.Ж. Демесинов

[1]Кенжеғали Сағадиев атындағы Халықаралық бизнес университеті, Алматы, Қазақстан,
[2]Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Астана, Қазақстан,
[3]Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан,
[4]Д.Серікбаев атындағы Шығыс Қазақстан техникалық университеті, Өскемен, Қазақстан,
[5]Ш. Уәлиханов атындағы Көкшетау университеті, Көкшетау, Қазақстан,
e-mail: maldynova.a@uib.kz

Денсаулық сақтауды цифрландыру бүкіл әлем бойынша денсаулық сақтау қызметтерінің тиімділігі мен қолжетімділігін арттырудың маңызды факторына айналуда. Қазақстанда цифрлық трансформация деңгейі өңірлер бойынша біркелкі емес. Бұл зерттеу Шығыс Қазақстан облысына бағытталған және цифрландырудың денсаулық сақтау қызметтеріне әсерін бағалауға және АКТ интеграциясы мен негізгі демографиялық көрсеткіштер арасындағы байланысты анықтауға бағытталған.

Зерттеу Қазақстан Республикасы Ұлттық статистика басқармасының статистикалық деректеріне, Денсаулық сақтау министрлігінің есептеріне және 2020–2024 жылдарға арналған халықаралық ақпарат көздеріне негізделген. Пайдаланылған әдістерге салыстырмалы және статистикалық талдау, трендтерді модельдеу және Өскемендегі денсаулық сақтаудың өңірлік инфрақұрылымына назар аудара отырып, географиялық контекстуализация кіреді.

Зерттеу АКТ мамандарының санының артуы мен өлім-жітім көрсеткіштерінің, әсіресе ана өлімінің жақсаруы арасындағы оң корреляцияны анықтады. Нәтижелер медицина қызметкерлерінің компьютерлік сауаттылығының екі есе артқанын, Интернетті кәсіби мақсатта пайдаланудың айтарлықтай артқанын және денсаулық сақтау мекемелерінде АКТ-ның біртіндеп, бірақ біркелкі емес енгізілуін көрсетеді. Оң динамикаға қарамастан, проблемалар сақталуда: АКТ-ны қаржыландырудың жеткіліксіздігі, киберқауіпсіздік мамандарының тапшылығы және оқыту мүмкіндіктерінің шектеулілігі. Бұл зерттеудің жаңалығы оның аймақтық бағытталуында: бұл Шығыс Қазақстан облысындағы денсаулық сақтау саласын цифрландырудың бірінші жүйелі талдауы. Нәтижелер аймақтық әркелкілікті ескере отырып, қолданыстағы теориялық негізді кеңейтеді және саясаткерлерге Қазақстандағы цифрлық денсаулық сақтау стратегияларын жетілдіру бойынша практикалық ұсыныстар береді.

Түйін сөздер: экономика, медициналық қызмет көрсету экономикасы, электрондық денсаулық сақтау, әлеуметтік-экономикалық даму, цифрландыру, ақпараттық-коммуникациялық технологиялар.

ЭКОНОМИЧЕСКИЙ АНАЛИЗ РАЗВИТИЯ ЦИФРОВОГО ЗДРАВООХРАНЕНИЯ В ВОСТОЧНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

[1]А.В. Малдынова✉, [2]Н. Айдаргалиева, [3]Д. Муссабалина, [4]Ж.С. Абдрахманова, [5]Т.Ж. Демесинов

[1]Университет международного бизнеса имени Кенжегали Сагадиева, Алматы, Казахстан,
[2]Евразийский национальный университет имени Л.Н. Гумилёва, Астана, Казахстан,
[3]Казахский национальный педагогический университет имени Абая, Алматы, Казахстан,
[4]Восточно-Казахстанский технический университет им. Д. Серикбаева, Усть-Каменогорск, Казахстан,
[5]Кокшетауский университет имени Ш. Уалиханова, Кокшетау, Казахстан,
e-mail: maldynova.a@uib.kz

Цифровизация здравоохранения становится важнейшим фактором повышения эффективности и доступности медицинских услуг во всем мире. В Казахстане уровень цифровой трансформации остается неравномерным по регионам. Данное исследование сосредоточено на Восточно-Казахстанской области и направлено на оценку влияния цифровизации на медицинские услуги и выявление взаимосвязи между интеграцией ИКТ и ключевыми демографическими показателями.

Исследование основано на статистических данных Национального статистического управления Республики Казахстан, отчётах Министерства здравоохранения и международных источниках за период 2020–2024 годов. Применённые методы включают сравнительный и статистический анализ, моделирование тенденций и географическую контекстуализацию с акцентом на региональную инфраструктуру здравоохранения в Усть-Каменогорске.

Исследование выявило положительную корреляцию между увеличением числа специалистов в области ИКТ и улучшением показателей смертности, особенно материнской. Результаты демонстрируют двукратный рост компьютерной грамотности медицинских работников, значительный рост использования интернета в профессиональных целях и постепенное, но неравномерное внедрение ИКТ в медицинских учреждениях. Несмотря на положительную динамику, сохраняются проблемы: недостаточное финансирование ИКТ, нехватка специалистов по кибербезопасности и ограниченные возможности обучения. Новизна данного исследования заключается в его региональной направленности: это первый систематический анализ цифровизации здравоохранения в

Восточно-Казахстанской области. Результаты расширяют существующие теоретические основы, учитывая региональную неоднородность, и предоставляют политикам практические рекомендации по совершенствованию стратегий цифрового здравоохранения в Казахстане.

Ключевые слова: экономика, экономика медицинских услуг, электронное здравоохранение, социально-экономическое развитие, цифровизация, информационно-коммуникационные технологии.

Introduction. In recent decades, digitalization has become a key area of transformation of socio-economic systems, including healthcare. Many countries have accumulated significant experience in implementing electronic medical records, telemedicine, and patient flow management systems, which has improved the efficiency of medical care. In the Republic of Kazakhstan, this process is also actively developing, but the level of digital integration of medical services in the regions remains uneven. The East Kazakhstan region is an interesting object of research due to the specifics of its demographic structure, the remoteness of individual settlements and differences in the availability of medical infrastructure [1].

It is important to note that in 2022 the East Kazakhstan Region underwent administrative restructuring, resulting in the establishment of the Abai Region. This territorial change affects the comparability of statistical indicators across the period analyzed. Therefore, data for 2020-2022 reflect the unified region, while indicators from 2023-2024 capture already reorganized administrative boundaries. This factor must be considered when interpreting trends in digital healthcare development.

The relevance of the topic is due to the need to improve the quality and accessibility of medical services for the population of the East Kazakhstan region in conditions of limited resources. Digital technologies make it possible to solve several critical problems: reduce waiting times, improve diagnostics, increase transparency and efficiency of patient interactions with medical organizations. In the post-pandemic period, digitalization of healthcare is becoming not only a tool for improving the quality of services, but also the most important factor in the sustainability of the entire healthcare system in the region [2]. The aim of the study is to analyze the impact of digitalization on the medical services market in the East Kazakhstan region and identify key areas of its development.

Most studies focus on the macro level - studying the digitalization of healthcare on a national scale. At the same time, regional features, such as the specifics of the East Kazakhstan region, remain insufficiently covered. The relationship between the level of digitalization and such indicators as the quality of medical services, patient satisfaction and the efficiency of medical personnel have also been insufficiently studied. The main problem is the insufficient empirical research of the impact of digital technologies on the regional market of medical services. The proposed solution is to conduct a comprehensive analysis of the digitalization of healthcare in the East Kazakhstan region based on statistical data, comparative analysis and forecast models. This approach will fill the identified gaps and offer practical recommendations for improving the digital infrastructure of healthcare in the region [3]. The novelty of the study lies in the fact that for the first time it presents a systemic analysis of the impact of digitalization on the medical services market of the East Kazakhstan region. Unlike existing works, the emphasis is on regional specifics and the relationship of digital technologies with socio-economic indicators in healthcare. The results of the study allow us to clarify the role of digital tools in increasing the sustainability of the regional healthcare system and to develop proposals for further digital transformation.

The growth of Internet penetration in Kazakhstan creates the preconditions for the expansion of telemedicine services, but an imbalance between urban and rural areas remains. According to DataReportal [4], the level of Internet access in Kazakhstan has reached 91%, but significant differences are observed by region. Freedom House [5] emphasizes that although mobile Internet covers

up to 94% of the population, the quality and stability of connections remain a problem in remote areas. A UNICEF study [6] shows that satellite solutions can provide equal access to digital education and healthcare in rural areas. Forecasts of the Internet Society [7], which notes Kazakhstan' s dependence on external data transmission channels, which reduces the resilience of digital services. In the global context, the basis for digital transformation is the WHO Global Strategy on Digital Health 2020–2025 [8, 9], which highlights the priorities of interoperability, data protection and personnel training. In Kazakhstan, the key regulatory act is the Code "On Public Health and the Healthcare System" [10], which enshrines provisions on remote medical services. According to the Intelehealth review [11], Kazakhstan is among the countries that have "mandatory" regulation of telemedicine at the level of national law. Publications of Integrated Approaches for Digital Health Transformation [12] demonstrate the active development of digital services through the eGov platform and the Damumed medical system, which provide an appointment with a doctor, access to test results and electronic interaction of the patient with the system.

International studies show that weak integration of systems and the lack of full interoperability remain one of the key barriers to digital healthcare. OECD [13] emphasizes that fragmentation of electronic medical platforms reduces efficiency and leads to duplication of processes. Analysis by Bhaskar et al. [14] confirms that successful implementation of telemedicine requires standardization and secure data exchange. In the US and EU, Pulse of the MedTech industry Report have proven their effectiveness in coordinating care [15], but in Kazakhstan, as noted by Seleznev et al. [16], there remain significant differences in the level of digitalization between regions, which is reflected in the East Kazakhstan region. COVID-19 has become a catalyst for the widespread adoption of telemedicine, demonstrating its potential to increase the availability of care. Telemedicine technologies, if properly regulated, are not inferior in quality to face-to-face consultations. In Kazakhstan, several empirical studies focus on patient perceptions of service quality. Shaki et al. [17] studied satisfaction in Almaty and found a positive impact of online consultations on trust in the system. Similar results were recorded in Astana, indicating an increase in patient satisfaction when using digital services. Moreover, Utegenova et al. [18] describe a successful pilot of telemedicine screening for cervical cancer in rural areas, demonstrating the potential of digitalization to reduce barriers to accessing specialized care.

WHO [19] notes that Kazakhstan has moved from paper registries to digital platforms over the past ten years, but sustainable transformation requires a significant expansion of the competencies of health workers. New challenges are associated not only with the use of basic HIS, but also with the integration of telemedicine, mobile applications and remote monitoring systems. The lack of digital skills among health workers in the regions, including Eastern Kazakhstan, is confirmed by UNICEF reports [20].

The medical sector worldwide remains one of the most vulnerable areas to cyber threats. According to the research of Kropachev P. [21], the number of attacks on medical organizations is growing annually, and the consequences include disruption of the continuity of care. In Kazakhstan, as emphasized by the OSCE [22], efforts are being made to develop public-private partnerships in the field of cyber resilience, but systemic risks remain significant.

Financing digital health requires sustainable models. Kazakhstan is gradually building mechanisms for integrating digital solutions into the general health system, but the volume of investment remains limited. The World Bank [23] points to the need for large-scale investments in data infrastructure and basic telecommunications, which is especially relevant for the East Kazakhstan region. Artificial intelligence is gradually being introduced into clinical practice. According to the World Bank [24], AI technologies can significantly improve the efficiency of diagnostics and remote monitoring in Central Asian countries. In the context of the multilingual environment

of Kazakhstan, multilingual models of clinical support [25] are of particular importance, ensuring the availability of medical information for the population.

Materials and methods. The object of the study is the process of digitalization of the healthcare system of the East Kazakhstan region. The following data were used as material: statistical data of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2016-2023) [26], official reports of the Ministry of Health of the Republic of Kazakhstan [27], data on the use of the Damumed medical information system [28], as well as publications of international organizations reflecting the trends in the digitalization of healthcare. Geographically, the study covers the territory of the East Kazakhstan region, with an emphasis on Ust-Kamenogorsk, the administrative center of the region, where a significant part of medical institutions is concentrated and where digital technologies are actively implemented.

Due to the administrative division of East Kazakhstan Region in 2022, part of the statistical data used in this study includes aggregated values for the former unified region. This may cause minor deviations in interannual comparisons. To minimize errors, indicators were normalized and interpreted with consideration of boundary changes.

Research methods. The following were used in the work:

- systems approach to analyzing digitalization as a complex socio-economic phenomenon;

- comparative analysis to compare the indicators of the East Kazakhstan region with other regions of Kazakhstan and the national average;

- statistical analysis;

- construction of trend models to assess the prospects for the introduction of digital

technologies in medicine in East Kazakhstan region for 5-6 years ahead.

Justification for the choice of region. East Kazakhstan region was chosen as the object of the study due to its specifics:

1. emographic heterogeneity - a combination of large cities (Ust-Kamenogorsk, Semey) and remote rural areas.

2. High load on the healthcare system - due to the large territory of the region and the need to provide medical care in hard-to-reach regions.

3. Practical significance - it is in East Kazakhstan region that digital technologies are actively being introduced, which allows us to assess their effectiveness at the regional level.

Comparative analysis shows that East Kazakhstan Region lags behind leading regions such as Astana, Almaty and Karaganda in ICT expenditures and availability of cybersecurity specialists but exceeds several western and southern regions in computer literacy among medical personnel and the share of healthcare institutions with Internet access. These differences illustrate the heterogeneous pace of digital healthcare development across Kazakhstan.

Results and discussions. An analysis of the dynamics of healthcare digitalization in the East Kazakhstan region for the period 2020-2024 revealed several sustainable trends reflecting changes in infrastructure, staffing, and the level of use of information and communication technologies.

At the national level, the number of organizations with ICT tools has increased by 22.66% over five years. In the healthcare sector, the growth in the number of computers was 87.51%. In the East Kazakhstan region, this figure was more modest - only +11.5%, but it is here that a significant share of organizations with Internet access is recorded: 91.5% of computers are connected to the network.

The total number of ICT specialists in Kazakhstan at the end of 2024 was 52,250 people, of which 10.2% are employed in the healthcare sector. In East Kazakhstan region, 2,502 specialists were registered, with only 0.2% working directly in healthcare. Over five years, the number of ICT specialists in the regional healthcare system increased by 1.64%. A noticeable increase was noted in the number of healthcare workers with computer literacy: +63.38% for 2020-2024.

An almost twofold increase was observed in the number of employees using the Internet in their professional activities. Detailed data on specialists and their competencies are presented in Table 1.

Table 1 - ICT specialists and knowledge (including public administration organizations), their changes over 5 years

Indicator	Number of organizations with ICT specialists, units	Number of employees with computer literacy, people	Number of specialists in information security, people	Number of employees who completed computer literacy training during the reporting year, people	Need for ICT specialists, people
2024					
Republic of Kazakhstan	9 730	1 951 523	11 241	39 731	4 924
Healthcare activities, in the Republic of Kazakhstan	825	316841	571	9569	271
East Kazakhstan region	452	157 348	225	668	314
Healthcare	38	25 546	11	161	17
2020					
Republic of Kazakhstan	9 494	1 406 336	2 193	144 225	6 781
Healthcare activities, in the Republic of Kazakhstan	642	189 523	104	24 300	325
East Kazakhstan region	508	90 784	21	4 455	427
Healthcare	34	12 234	1	751	20
Changes					
Republic of Kazakhstan	2,49%	38,77%	412,59%	-72,45%	-27,39%
Healthcare activities, in the Republic of Kazakhstan	28,50%	67,18%	449,04%	-60,62%	-16,62%
East Kazakhstan region	-11,02%	73,32%	971,43%	-85,01%	-26,46%
Healthcare	11,57%	108,81%	1047,62%	-78,57%	-15,56%

Compiled by the authors based on the source [29]

As of the end of 2024, 104,518 organizations in Kazakhstan used the Internet to interact with government agencies. In the East Kazakhstan region, 293 such organizations were recorded in healthcare, which is 43.83% higher than in 2020. In the structure of Internet use in healthcare organizations in the region, the largest share is for receiving information and sending forms electronically, and the smallest is for participating in open tenders.

A comparative assessment of East Kazakhstan Region against other major regions of Kazakhstan demonstrates a heterogeneous landscape of digital healthcare development across the country. According to national statistics [29], the growth rate of employees with computer literacy in East Kazakhstan Region (+108.8% over 2020-2024) exceeds the national average (+67.2%). This indicates a comparatively faster adoption of basic digital competencies among healthcare personnel at the regional level.

However, East Kazakhstan Region lags behind technologically advanced regions such as Astana, Almaty and Karaganda in terms of ICT expenditures and the availability of cybersecurity specialists. For example, while national ICT spending in healthcare increased by 22% over the past five years, ICT-related expenditures in East Kazakhstan Region decreased by more than 50%, reflecting structural funding limitations. In contrast, regions with higher investment levels demonstrate broader implementation of integrated medical information systems and wider use of telemedicine services.

Table 2 - Comparative assessment of digital healthcare indicators across selected regions of Kazakhstan

Indicator	East Kazakhstan Region	Astana	Almaty	Karaganda Region	National Average
Growth in computer literacy among healthcare workers (2020-2024)	High	High	High	Medium–High	Medium
ICT expenditures in healthcare	Low / Declining	High	High	Medium	Moderate (Increasing)
Availability of ICT specialists	Low	High	High	Medium	Medium
Internet connectivity of healthcare facilities	High	Very High	Very High	High	Medium–High
Adoption of telemedicine and digital services	Medium	Very High	High	Medium	Medium
Level of interoperability between medical systems	Low–Medium	High	Medium–High	Medium	Medium
Cybersecurity capacity	Very Low	High	Medium–High	Medium	Low–Medium
Compiled by the authors					

In terms of infrastructure, Internet connectivity among healthcare organizations in East Kazakhstan Region (91.5% in 2024) is above the average for several western and southern regions of the country, yet remains below the levels observed in large metropolitan centers, where near-full digital coverage has already been achieved. This suggests that the region shows moderate–high readiness but still faces gaps in advanced ICT capacity.

Overall, the interregional comparison confirms

that although East Kazakhstan Region demonstrates comparatively strong progress in basic digital skills and infrastructure availability, it remains constrained by insufficient ICT investment and a shortage of specialized digital personnel. Addressing these gaps is essential for ensuring that the region's digital transformation aligns with national development trends (table 2).

The comparative analysis demonstrates that East Kazakhstan Region exhibits strong progress in basic digital competencies, particularly in the growth of computer literacy among healthcare workers, where it outperforms the national average. However, the region lags behind technologically advanced centers-Astana, Almaty, and, to a lesser extent, Karaganda Region-across several critical dimensions, including ICT expenditures, availability of specialized ICT personnel, and cybersecurity capacity.

Despite relatively high levels of Internet connectivity in healthcare institutions, East Kazakhstan Region remains limited in terms of advanced digital transformation, particularly system interoperability and adoption of telemedicine. These disparities highlight the need for targeted investments, improved training programs, and the development of a stronger ICT workforce to align the region's digital healthcare trajectory with national leaders.

To assess the future trajectory of digital healthcare development in the East Kazakhstan Region, a trend-based forecasting model was constructed using statistical data for 2020–2024. The model projects the dynamics of two key indicators:

- the number of ICT specialists employed in the regional healthcare system;

- the share of healthcare workers possessing digital competencies.

A linear trend model demonstrated the best explanatory power, which is supported by relatively high determination coefficients (R^2 = 0.71-0.84). According to the model, if the current growth rate (k = 1.087) is maintained, the number of ICT specialists in the regional healthcare system will increase by approximately 52–58% by 2030. Similarly, the share of digitally competent healthcare personnel is expected to reach 24–28% by 2030.

The resulting forecast of digitally competent healthcare workers is presented in Figure 1.

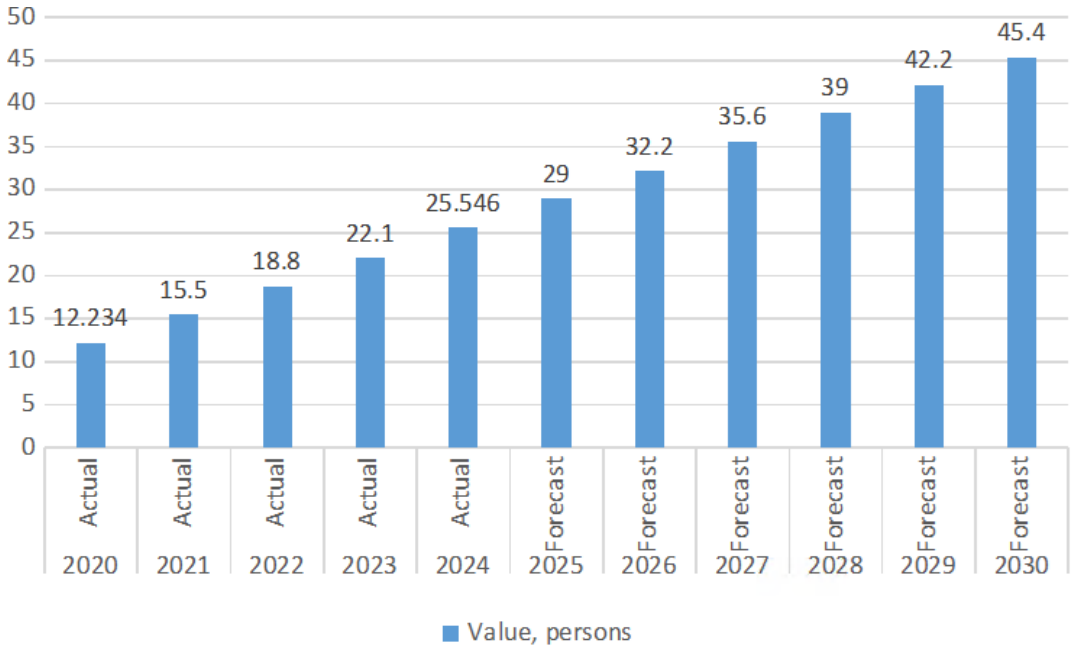


Fig.1 - Forecast of digitally competent healthcare workers in the East Kazakhstan Region (2020-2030)

Compiled by the authors based on the source [29]

During the study period, total ICT spending in Kazakhstan amounted to 443,121 million tenge. The East Kazakhstan region accounted for 16,742 million tenge, of which only 524 million tenge was for healthcare. Moreover, in the region' s healthcare, ICT costs decreased by 50.7%. The dynamics of changes in expenses in the context of 2020–2021 are shown in Figure 2.

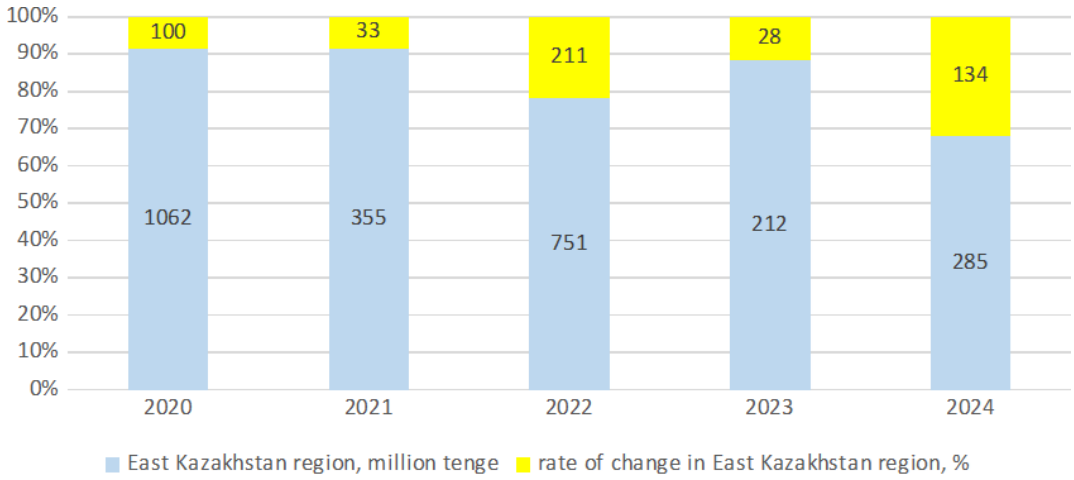


Fig.2 - Dynamics of changes in ICT costs in the healthcare sector, in the East Kazakhstan region
Compiled by the authors based on the source [29]

By 2024, healthcare organizations in the East Kazakhstan region with ICT specialists accounted for 4.6% of the total, equivalent to 8.5% of all organizations in the region. The number of employees with computer literacy reached 16.2%, more than doubling since 2020. Thus, the region has demonstrated positive dynamics in digital development, although several problem areas remain limited funding, weak development of human resources in the field of information security, and insufficient coverage of training programs.

Since 2020, the amount of ICT costs in healthcare has not exceeded 1,062 million tenge, in 2021 the rate of change decreased by 67%, in 2022 an increase of 2.1 times, in 2023 a decrease again by 72%, then in 2024 an increase of 34% (Figure 3).

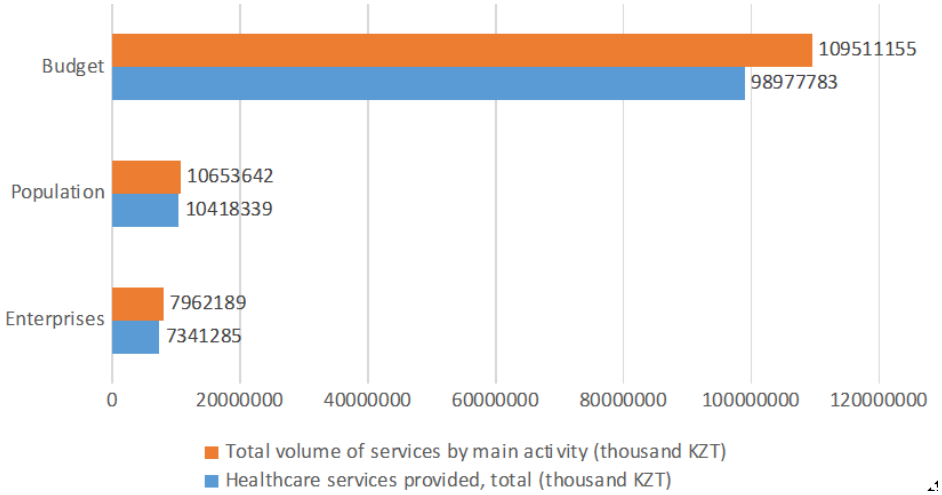


Fig.3 - Volume of services rendered in the field of healthcare and provision of social services by types of activity in East Kazakhstan region, thousand tenge
Compiled by the authors based on the source [29]

Analysis of the dynamics of the volume of medical services rendered in the East Kazakhstan region for the period 2020-2024 shows steady growth. Over the past five years, the total volume of services has almost doubled, which reflects both the growing need of the population for medical care and the active development of digitalization and optimization of organizational processes.

In 2024, the total volume of services rendered amounted to 128,588 million tenge, of which:

- 85.2% (109,621 million tenge) was financed from budget funds;

- 8.4% (10,780 million tenge) from the population's own funds;

- 6.4% (8,186 million tenge) at the expense of enterprises.

Of the total, 116,737 million tenge went to the healthcare sector. The structure of the inflow of funds is presented in Figure 3, which details the areas of financing.

The share of the East Kazakhstan region in the total volume of medical services in the Republic of Kazakhstan was 6.6%, which confirms the importance of the region in the formation of national indicators.

Structural analysis of costs shows that the largest part falls on hospital services - 35.28% (63,641 million tenge), of which 94.7% is provided by budget financing, 3.1% - by population funds and 2.1% by enterprises. A detailed structure of the distribution of costs by areas is presented in Figure 4.

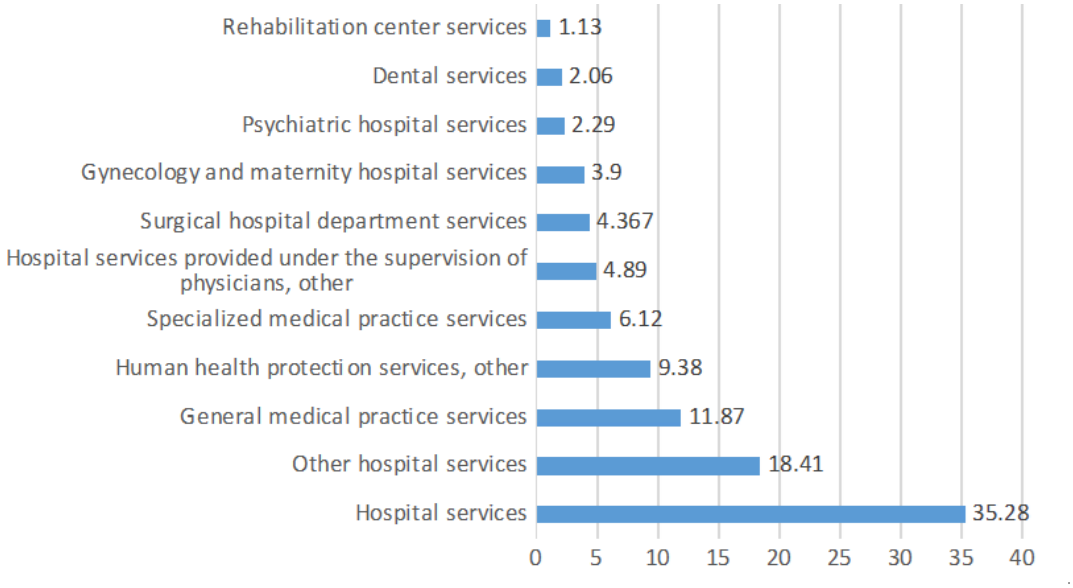


Fig.4 - Structure of rendered services in the field of healthcare in the East Kazakhstan region, for 2024
Compiled by the authors based on the source [29]

In second place are the services of other hospitals - 18.41%, 93.3% are provided at the expense of the budget. The smallest share falls on the services of rehabilitation centers - 1.13%, where 20.3% are at the expense of the budget (754 million tenge), 74.4% - at the expense of the population, and 5.3% - at the expense of enterprises.

As part of the analysis, the health indicators of the population in the East Kazakhstan region were considered (Table 3).

The observed improvements in several health indicators are not only a consequence of general modernization of the healthcare system but are also closely linked to the expansion of digital tools. The wider use of electronic medical records, online appointment systems and telemedicine consultations has contributed to reducing time-to-diagnosis, improving continuity of care

and increasing transparency in patient-provider interactions. For remote rural settlements, digital channels have partially mitigated geographical barriers by enabling access to specialized services that were previously concentrated in large urban centres.

Table 3 - Main indicators of the health of the population of the East Kazakhstan region

Name of indicators	2021	2022	2023	2024
Birth rate, % per 1000 people (15–49)	66,29	66,65	67,87	71,13
Death rate, % per 1000 people	10,29	10,36	12,06	12,80
Natural increase rate, % per 1000 people	56,00	56,29	55,81	58,33
Maternal mortality rate, % per 1000 live births	34,3	23,5	44,9	50,0
Infant mortality rate, % per 1000 live births	7,28	7,99	8,24	7,4
Tuberculosis incidence, per 100 thousand people	45,8	39,65	33,5	27,5
including tuberculosis mortality	2,1	2,0	2,0	1,9
Malignant diseases, per 100 thousand people	321,54	295,26	286,05	277,18
incl. Mortality from malignant diseases	137,42	128,31	128,32	125,63
Cystolic diseases, per 100 thousand people	4634,5	3671,05	3650,25	3340,39
incl. mortality from CDS	255,88	304,63	335,93	322,83
Accidents, injuries, poisonings, per 100 thousand people	242	282	302	314
incl. mortality from accidents, injuries and poisonings	20	21	14	24
Compiled by the authors based on the source [29]				

From a socio-economic perspective, digitalization has helped to optimize resource allocation, reduce transaction costs for both providers and patients and improve the efficiency of administrative processes. At the same time, uneven ICT funding and limited digital skills in certain groups of healthcare workers preserve inequalities in access and quality of services. Thus, digital transformation of healthcare in the East Kazakhstan Region simultaneously acts as a factor of increased accessibility and as a source of new risks related to the “digital divide”, which must be addressed in regional health policy.

Thus, in 2020-2024, there is a positive trend in chronic diseases, which is associated with both improved diagnostics and the wider use of digital technologies to monitor public health.

A negative trend was the increase in the number of accidents, injuries and poisoning: the growth was 29.8%. This fact requires a separate analysis in terms of preventive measures and the integration of digital security systems.

Taken together, these indicators confirm the impact of healthcare digitalization on increasing the resilience of the system, especially in the context of pandemics and crisis factors. However, risks associated with high mortality during epidemics and an increase in the number of accidents remain, requiring an integrated approach and modernization of preventive measures (figure 5).

Figure 4 shows the dynamics of changes in the rates of overall, maternal and infant mortality in comparison with the growth rate of the number of organizations with specialists in the field of ICT health care in the East Kazakhstan region. The data obtained confirms the presence of an inverse relationship between these indicators: with a decrease in the rate of involvement of specialists in digital technologies, mortality rates tend to increase,

while with an increase in the number of human resources, stabilization or a decrease in mortality is observed.

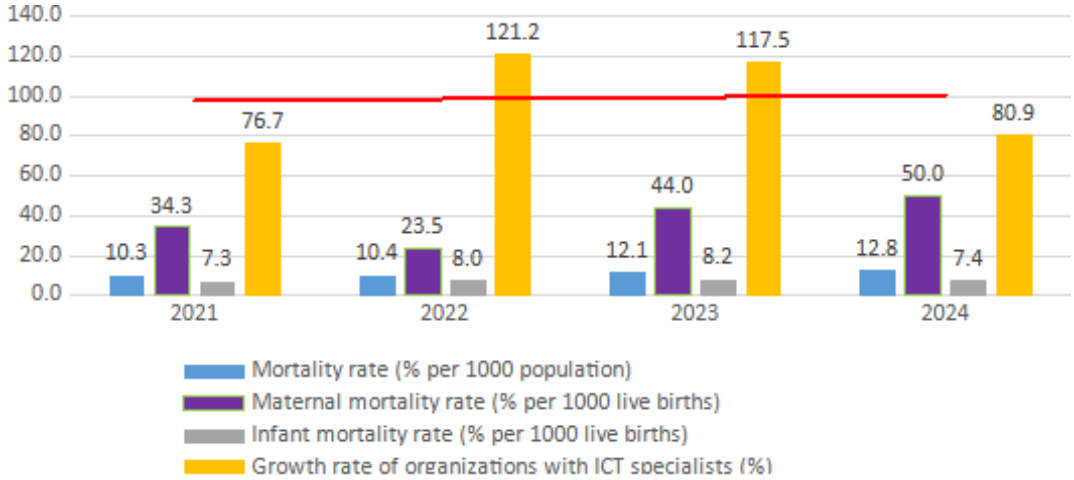


Fig.5 - Dynamics of changes in mortality rates relative to the number of specialists in the field of ICT health care in the East Kazakhstan region

Compiled by the authors based on the source [29]

In 2020-2021, an increase in mortality rates is recorded, which is explained by the consequences of the COVID-19 pandemic, when limited human and digital resources were unable to compensate for the burden on the healthcare system. In subsequent years, with an increase in the number of ICT specialists in medical institutions in the region, a gradual decrease in mortality rates, especially maternal, is noted.

The results of research confirm that digitalization in healthcare in East Kazakhstan Region has a direct impact on both access to and quality of medical services. For example, Assel Murat et al. [30] found that during the COVID-19 pandemic in Kazakhstan, the efficacy of primary healthcare was significantly associated with improvements in ICT infrastructure, professional development of staff, and resource availability (such as equipment and medicines). Similarly, Nurgaliyeva, Z. et al. [31] report that Kazakhstan has made significant strides in digital health implementation, with measurable growth in online and digital health processes.

At the regional level, findings that the number of ICT-specialists rise in East Kazakhstan corresponds with declines in mortality and improvements in medical facility outcomes—are consistent with results by Bagym Jobalayeva et al. [32] demonstrate that reform policies and investments have led to better availability of health facilities in rural areas, albeit with ongoing inequalities.

Interoperability remains a central challenge. In the same vein, WHO Europe [33] emphasizes that without integrated systems and standardized data exchange, digital health platforms cannot realize their full potential. Kazakhstan's progress is similarly constrained by low interoperability between medical information systems, as observed in the research.

Cybersecurity is another area needing urgent attention. Increasing attacks on healthcare providers globally. In parallel, Kazakhstan's healthcare sector reveals a critical gap: a very limited number of specialists in information security, which aligns with regional data.

Conclusion. The novelty of the research is that for the first time a comprehensive analysis of the impact of digitalization on the medical services market in the East Kazakhstan region was conducted, with an emphasis on the relationship between the level of digital readiness of medical organizations and key socio-demographic

indicators, such as mortality, birth rate and quality of medical services. Unlike previous studies, which focused mainly on the national or international level, this work focuses on regional specifics, which made it possible to identify unique patterns and clarify the role of digitalization in ensuring the sustainability of the healthcare system. From a theoretical point of view, the results of the study contribute to a deeper understanding of the processes of digital transformation of healthcare in the context of regional heterogeneity. The findings confirm the provisions of the WHO global strategy for digital health but clarify them in relation to the Kazakhstan context. It was demonstrated that the dynamics of mortality reduction and improvement of population health indicators directly depend on the level of development of digital competencies of specialists and the availability of ICT infrastructure in the region.

The practical significance of the study lies in the possibility of using its results by healthcare authorities and regional administrations when planning and developing digital infrastructure. The identified trends show that improving the computer literacy of healthcare workers and investing in information security led to a decrease in mortality and an increase in the quality of services. Practical recommendations can be applied to optimize government programs, develop telemedicine and increase the resilience of the healthcare system to crises, including pandemics. In addition, the results of the study can be useful for educational institutions training specialists in the field of healthcare and ICT, as well as for private companies involved in the creation and implementation of medical information systems. The study has several limitations that must be considered when interpreting the results. Firstly, the work is based mainly on statistical data for the period 2020-2024, which limits the possibility of long-term conclusions. Secondly, the analysis was carried out within one region - the East Kazakhstan region, so its results may not fully reflect the situation in other regions of Kazakhstan. Third, the research focuses on macro indicators, while micro perspectives - such as individual patient experiences or subjective assessment of the quality of health care - remain outside the scope of the work.

Prospects for further research are related to the need for an in-depth analysis of the impact of digitalization on the quality of medical services in various socio-demographic groups of the population. In the future, it is advisable to conduct interregional comparative studies to identify differences and common patterns in the digital transformation of healthcare in Kazakhstan. An important area remains the study of cybersecurity factors and the protection of personal data, since the growth of digitalization is inevitably accompanied by an increase in digital risks. It is also relevant to study the effectiveness of individual digital tools - telemedicine, mobile applications, remote monitoring systems - from the standpoint of their impact on clinical outcomes and patient satisfaction. Of additional interest is the development of forecasting models that take into account not only technical and human resources, but also the socio-economic characteristics of the region. All this will allow us to formulate more accurate strategies for the digital development of healthcare in Kazakhstan and beyond.

Литература

1. Об утверждении Государственной программы развития здравоохранения Республики Казахстанна 2020-2-25годы URL: https://adilet.zan.kz/rus/docs/P1900000982/history.-*Дата* обращения: 29.07.2025.

2. Global Strategy on Digital Health 2020–2025/ Geneva: World Health Organization. -2021. -72 p. ISBN 978-92-4-002092-4, 978-92-4-002093-1.

3. Slawomirski L., Wenzl M., et al. Health in the 21st Century: Putting Data to Work for Stronger Health Systems// OECD Publishing. -2019. -220 p. DOI 10.1787/e3b23f8e-en.

4. DataReportal. Digital 2023: Kazakhstan. DataReportal. -2023. URL: https://datareportal.com/reports/digital-2023-kazakhstan. -Date of access: 29.07.2025.

5. Bake G., et al. Freedom House. Freedom on the Net 2023*:* The Repressive Power of Artificial Intelligence/Freedom House. -2023. URL: https://freedomhouse.org/sites/default/files/2023-10/Freedom-on-the-net-2023-DigitalBooklet.pdf. -Date of access: 29.07.2025.

6. UNICEF. UNICEF Annual State of Digital Transformation. UNICEF Report. - 2024. URL: https://www.unicef.org/reports/unicef-annual-state-digital-transformation-dx. -Date of access: 29.07.2025.

7. Internet Society. Global Internet Resilience Report 2024/ The Marcony Society. -2024. URL: https://marconisociety.org/wp-content/uploads/2025/02/IR-Technology-Institute-Report-2024-compressed.pdf. -Date of access: 19.08.2025.

8. World Health Organization. Recommendations on digital interventions for health system strengthening. WHO. - 2023. ISBN 978-92-4-155050-5.

9. World Health Organization. Global Digital Health Monitor Releases State of Digital Health 2024 Brief. Geneva: WHO. -2024. URL: https://digitalhealthmonitor.org/news/global-digital-health-monitor-releases-state-of-digital-health-2024-brief. -Date of access: 25.08.2025.

10. Ministry of Justice of the Republic of Kazakhstan. Code of the Republic of Kazakhstan “On the Health of the People and the Healthcare System” dated July 7, 2020 No.360-VI ZRK. -2020. URL: https://adilet.zan.kz/eng/docs/K2000000360. -Date of access: 25.08.2025.

11. Tripathy A., et al. Global Telemedicine Regulations Report 2023. Intelehealth. -2023. URL: https://intelehealth.org/wp-content/uploads/2023/06/TELEMEDICINE-REPORT-12-June-2023.pdf. -Date of access: 20.08.2025.

12. Joint Programme Document: Integrated Approaches for Digital Health Transformation in Kazakhstan. UNDP/UN Joint SDG Fund. -2025. URL: https://mptf.undp.org/sites/default/files/documents/2025-04/extracted_from_kazakhstan_prodoc_141119.pdf. -Date of access: 20.08.2025.

13. OECD. Health Data Governance: Principles and Practices/ OECD Publishing. -2015. URL: https://www.oecd.org/en/publications/health-data-governance_9789264244566-en.html. -Date of access: 20.08.2025.

14. Bhaskar S., et al. Telemedicine Across the Globe-Position Paper from the COVID-19 Pandemic Health System Resilience PROGRAM (REPROGRAM) International Consortium (Part 1)// Fronties in Public Health. -2020. -Vol.8: 556720. DOI 10.3389/fpubh.2020.556720.

15. Ernst & Young. Pulse of the MedTech industry: Outlook. URL: https://www.ey.com/en_us/life-sciences/pulse-of-medtech-industry-outlook. -Date of access: 29.08.2025.

16. Qumar AB, Faizullina K, Seiduanova l, Yelibay A, Zhamankulova N, Mukashev N. Digital Transformation in Healthcare: Global Best Practices and Kazakhstan’ s Prospects. Central Asian Journal of Medical Hypotheses and Ethics. -2025. -№6(2). -P.125-132. DOI 10.47316/cajmhe.2025.6.2.06.

17. Shaki D., Aimbetova G., Baysugurova V., Kanushina M., Chegebayeva A., Arailym M., Merkibekov E., Karibayeva I. Level of Patient Satisfaction with Quality of Primary Healthcare in Almaty During COVID-19 Pandemic // International Journal of Environmental Research and Public Health. -2025. -Vol.22 (5): 804. DOI 10.3390/ijerph22050804.

18. Utegenova A., Kassymova G., Fakhradiyev I. Experience of Implementing Digital Telemedicine Technologies to Improve Access to Cervical Cancer Screening in Rural Areas of the Republic of Kazakhstan // Georgian Medical News. -2025. -Vol.360. -P.187–194.

19. World Health Organization (WHO Europe). Digital Health in Kazakhstan: Progress and Challenges.

WHO Regional Office for Europe. -2023. -45 p. URL: https://www.euro.who.int/en/health-topics/Health-systems/digital-health. -Date of access: 27.08.2025.

20. UNICEF Kazakhstan. Assessment of Digital Public Goods in Kazakhstan/RFP/KAZA/2021/001. -2021. URL: https://www.unicef.org/kazakhstan/media/7706/file/Presentation%203.pdf. -Date of access: 27.08.2025.

21. Kropachev P., Imanov M., Borisevich J., Dhomane I. Information Technologies and The Future of Educationin The Republic of Kazakhstan // Scientific Journal Of Astana IT University. -2020. -Vol.1. -P.30-38. DOI 10.37943/AITU.2020.1.63639.

22. Organization for Security and Co-operation in Europe (OSCE). Public-Private Partnerships in Cyber Resilience: Kazakhstan Case Study. Vienna: OSCE. -2023. -52 p. URL: https://www.osce.org/files/f/documents/1/2/536789.pdf. -Date of access: 29.08.2025.

23.Ministry of Health of the Republic of Kazakhstan. State Program for the Development of Healthcare of the Republic of Kazakhstan for 2020-2025. -2020. -145 p. URL: https://cis-legislation.com/document.fwx?rgn=121946#A5OQ0IMM30. -Date of access: 29.08.2025.

24. World Bank. Digital Progress and Trends Report 2025: Strengthening AI Foundations. - Washington: The World Bank, 2025. URL: https://openknowledge.worldbank.org/server/api/core/bitstreams/f2509a0f-7153-4f32-b180-bc11e90c4940/content. -Date of access: 29.08.2025.

25. Digital Journey: Kazakhstan’s Healthcare. - Official website of the Ministry of Health of the Republic of Kazakhstan. https://www.gov.kz/memleket/entities/dsm/press/article/details/4848.

26. Бюро национальной статистики Агентства стратегического планирования и реформ Республики Казахстан. Статистика здравоохранения Республики Казахстан, 2016-2023 гг.. -2023. -120 р. URL: https://stat.gov.kz/healthcare-statistics-2016-2023. - Дата обращения: 28.08.2025.

27. Astana International Financial Centre. Annual Report 2020. - Астана: Astana International Financial Centre «AIFC». -2021. URL: https://aifc.kz/wp-content/uploads/2024/06/aifc_ar2020_eng.pdf. -Date of access: 28.08.2025

28. Дамумед. Официальный сайт Единой медицинской информационной системы Казахстан 2025. URL: https://damumed.kz. -Дата обращения: 29.08.2025.

29. Комитет по статистике Министерства народного хозяйства Республики Казахстан. Официальный портал статистических данных. -2025. URL: https://stat.gov.kz. -Дата обращения: 29.08.2025.

30. Murat A., et al. Effectiveness of primary health care in the Republic of Kazakhstan during the COVID-19 pandemic and factors affecting it// Disaster and Emergency. -2024. -Vol.9(4). -P.208-225. DOI 10.5603/demj.101057.

31. Nurgaliyeva Z., Berkinbayev S., Zhunussova A. Paving the way to establishing the digital-friendly health system in Kazakhstan// Health Policy and Technology. -2024. -Vol.192: 105610. DOI 10.1016/j.ijmedinf.2024.105610.

32. Jobalayeva B., et al. Past, current status, and future trends of the rural healthcare network in the Republic of Kazakhstan//Scientific Reports. -2025. -Vol.15: 26913. DOI 10.1038/s41598-025-11432-w.

33. World Health Organization, Regional Office for Europe. Addressing the growing needs of Kazakhstan’s digital health workforce. WHO Europe News. -2023. URL: https://www.who.int. - Date of access: 29.08.2025.

References

1. Ob utverzhdenii Gosudarstvennoj programmy razvitija zdravoohranenija Respubliki Kazahstanna

2020-2-25gody URL: https://adilet.zan.kz/rus/docs/P1900000982/history .- Data obrashhenija: 29.07.2025. [in Russian]

2. Global Strategy on Digital Health 2020–2025/ Geneva: World Health Organization. -2021. -72 p. ISBN 978-92-4-002092-4, 978-92-4-002093-1.

3. Slawomirski L., Wenzl M., et al. Health in the 21st Century: Putting Data to Work for Stronger Health Systems// OECD Publishing. -2019. -220 p. DOI 10.1787/e3b23f8e-en.

4. DataReportal. Digital 2023: Kazakhstan. DataReportal. -2023. URL: https://datareportal.com/reports/digital-2023-kazakhstan. -Date of access: 29.07.2025.

5. Bake G., et al. Freedom House. Freedom on the Net 2023*:* The Repressive Power of Artificial Intelligence/Freedom House. -2023. URL: https://freedomhouse.org/sites/default/files/2023-10/Freedom-on-the-net-2023-DigitalBooklet.pdf. -Date of access: 29.07.2025.

6. UNICEF. UNICEF Annual State of Digital Transformation. UNICEF Report. - 2024. URL: https://www.unicef.org/reports/unicef-annual-state-digital-transformation-dx. -Date of access: 29.07.2025.

7. Internet Society. Global Internet Resilience Report 2024/ The Marcony Society. -2024. URL: https://marconisociety.org/wp-content/uploads/2025/02/IR-Technology-Institute-Report-2024-compressed.pdf. -Date of access: 19.08.2025.

8. World Health Organization. Recommendations on digital interventions for health system strengthening. WHO. - 2023. ISBN 978-92-4-155050-5.

9. World Health Organization. Global Digital Health Monitor Releases State of Digital Health 2024 Brief. Geneva: WHO. -2024. URL: https://digitalhealthmonitor.org/news/global-digital-health-monitor-releases-state-of-digital-health-2024-brief. -Date of access :25.08.2025.

10. Ministry of Justice of the Republic of Kazakhstan. Code of the Republic of Kazakhstan “On the Health of the People and the Healthcare System” dated July 7, 2020 No.360-VI ZRK. -2020. URL: https://adilet.zan.kz/eng/docs/K2000000360. -Date of access: 25.08.2025.

11. Tripathy A., et al. Global Telemedicine Regulations Report 2023. Intelehealth. -2023. URL: https://intelehealth.org/wp-content/uploads/2023/06/TELEMEDICINE-REPORT-12-June-2023.pdf. -Date of access: 20.08.2025.

12. Joint Programme Document: Integrated Approaches for Digital Health Transformation in Kazakhstan. UNDP / UN Joint SDG Fund. -2025. URL: https://mptf.undp.org/sites/default/files/documents/2025-04/extracted_from_kazakhstan_prodoc_141119.pdf. -Date of access: 20.08.2025.

13. OECD. Health Data Governance: Principles and Practices/ OECD Publishing. -2015. URL: https://www.oecd.org/en/publications/health-data-governance_9789264244566-en.html. -Date of access: 20.08.2025.

14. Bhaskar S., et al. Telemedicine Across the Globe-Position Paper from the COVID-19 Pandemic Health System Resilience PROGRAM (REPROGRAM) International Consortium (Part 1)// Fronties in Public Health. -2020. -Vol.8: 556720. DOI 10.3389/fpubh.2020.556720.

15. Ernst & Young. Pulse of the MedTech industry: Outlook. URL: https://www.ey.com/en_us/life-sciences/pulse-of-medtech-industry-outlook. -Date of access: 29.08.2025.

16. Qumar AB, Faizullina K, Seiduanova l, Yelibay A, Zhamankulova N, Mukashev N. Digital Transformation in Healthcare: Global Best Practices and Kazakhstan’ s Prospects. Central Asian Journal of Medical Hypotheses and Ethics. -2025. -№6(2). -P.125-132. DOI 10.47316/cajmhe.2025.6.2.06.

17. Shaki D., Aimbetova G., Baysugurova V., Kanushina M., Chegebayeva A., Arailym M., Merkibekov E., Karibayeva I. Level of Patient Satisfaction with Quality of Primary Healthcare in Almaty During

COVID-19 Pandemic // International Journal of Environmental Research and Public Health. -2025. -Vol.22 (5): 804. DOI 10.3390/ijerph22050804.

18. Utegenova A., Kassymova G., Fakhradiyev I. Experience of Implementing Digital Telemedicine Technologies to Improve Access to Cervical Cancer Screening in Rural Areas of the Republic of Kazakhstan // Georgian Medical News. -2025. -Vol.360. -P.187–194.

19. World Health Organization (WHO Europe). Digital Health in Kazakhstan: Progress and Challenges. WHO Regional Office for Europe. -2023. -45 p. URL: https://www.euro.who.int/en/health-topics/Health-systems/digital-health. -Date of access: 27.08.2025.

20. UNICEF Kazakhstan. Assessment of Digital Public Goods in Kazakhstan/RFP/KAZA/2021/001. -2021. URL: https://www.unicef.org/kazakhstan/media/7706/file/Presentation%203.pdf. -Date of access: 27.08.2025.

21. Kropachev P., Imanov M., Borisevich J., Dhomane I. Information Technologies and The Future of Educationin The Republic of Kazakhstan // Scientific Journal Of Astana IT University. -2020. -Vol.1. -P.30-38. DOI 10.37943/AITU.2020.1.63639.

22. Organization for Security and Co-operation in Europe (OSCE). Public-Private Partnerships in Cyber Resilience: Kazakhstan Case Study. Vienna: OSCE. -2023. -52 p. URL: https://www.osce.org/files/f/documents/1/2/536789.pdf. -Date of access: 29.08.2025.

23.Ministry of Health of the Republic of Kazakhstan. State Program for the Development of Healthcare of the Republic of Kazakhstan for 2020–2025. -2020. -145 p. URL: https://cis-legislation.com/document.fwx?rgn=121946#A5OQ0IMM30. -Date of access: 29.08.2025.

24. World Bank. Digital Progress and Trends Report 2025: Strengthening AI Foundations. - Washington: The World Bank, 2025. URL: https://openknowledge.worldbank.org/server/api/core/bitstreams/f2509a0f-7153-4f32-b180-bc11e90c4940/content. -Date of access: 29.08.2025.

25. Digital Journey: Kazakhstan’s Healthcare. - Official website of the Ministry of Health of the Republic of Kazakhstan. https://www.gov.kz/memleket/entities/dsm/press/article/details/4848

26. Bjuro nacional’ noj statistiki Agentstva strategicheskogo planirovanija i reform Respubliki Kazahstan. Statistika zdravoohranenija Respubliki Kazahstan, 2016–2023 gg.. -2023. -120 p. URL: https://stat.gov.kz/healthcare-statistics-2016-2023. - Data obrashhenija: 28.08.2025.[in Russian]

27. Astana International Financial Centre. Annual Report 2020. - Астана: Astana International Financial Centre «AIFC». -2021. URL: https://aifc.kz/wp-content/uploads/2024/06/aifc_ar2020_eng.pdf. -Date of access:28.08.2025.

28. Damumed. Oficial’ nyj sajt Edinoj medicinskoj informacionnoj sistemy Kazahstan 2025. URL: https://damumed.kz. - Data obrashhenija: 29.08.2025. [in Russian]

29. Komitet po statistike Ministerstva narodnogo hozjajstva Respubliki Kazahstan. Oficial’ nyj portal statisticheskih dannyh. -2025. URL: https://stat.gov.kz. - Data obrashhenija: 29.08.2025. [in Russian]

30. Murat A., et al. Effectiveness of primary health care in the Republic of Kazakhstan during the COVID-19 pandemic and factors affecting it// Disaster and Emergency. -2024. -Vol.9(4). -P.208-225. DOI 10.5603/demj.101057.

31. Nurgaliyeva Z., Berkinbayev S., Zhunussova A. Paving the way to establishing the digital-friendly health system in Kazakhstan// Health Policy and Technology. -2024. -Vol.192: 105610. DOI 10.1016/j.ijmedinf.2024.105610.

32. Jobalayeva B., et al. Past, current status, and future trends of the rural healthcare network in the Republic of Kazakhstan//Scientific Reports. -2025. -Vol.15: 26913. DOI 10.1038/s41598-025-11432-w.

33. World Health Organization, Regional Office for Europe. Addressing the growing needs of Kazakhstan’s digital health workforce. WHO Europe News. -2023. URL: https://www.who.int. - Date of access 29.08.2025.

Сведения об авторах

Малдынова А. - PhD, доцент, Университет Международного Бизнеса им. Кенжегали Сагадиева, Алматы, Казахстан, e-mail: maldynova.a@uib.kz;

Айдаргалиева Н. - PhD, доцент, Евразийский национальный университет им. Л.Н. Гумилёва, Астана, Казахстан, e-mail: aidargaliyeva@enu.kz;

Мусабалина Д. - PhD, постдокторант, Казахский национальный педагогический университет им. Абая, Алматы, Казахстан, e-mail: d.mussabalina@gmail.com;

Абдрахманова Ж. - старший преподаватель, Восточно-Казахстанский технический университет им. Д. Серикбаева, Усть-Каменогорск, Казахстан, e-mail: abdrakhmanova.zhannur@inbox.ru;

Демесинов Т. - кандидат экономических наук, ассоциированный профессор, НАО «Кокшетауский университет им. Ш.Уалиханова», Кокшетау, Казахстан. e-mail: demesinov73@list.ru.

Information about authors

Maldynova A.- PhD, Associate Professor, Kenzhegali Sagadiyev University of International Business, Almaty, Kazakhstan, e-mail: maldynova.a@uib.kz;

Aidargaliyeva N. - PhD, Associate Professor, L.N. Gumilyov Eurasian National University, Astana, Kazakhstan, e-mail: aidargaliyeva@enu.kz;

Mussabalina D.- PhD, Postdoctoral Researcher, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan, e-mail: d.mussabalina@gmail.com;

Abdrakhmanova Z. - senior lecturer, D.Serikbayev East Kazakhstan Technical University, Ust-Kamenogorsk, Kazakhstan, e-mail: abdrakhmanova.zhannur@inbox.ru;

Demessinov T. - Candidate of Economic Sciences, Associate Professor, Sh. Ualikhanov Kokshetau University, Kokshetau, Kazakhstan., e-mail: demesinov73@list.ru.