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### The Impact of Healthcare Financing on Labor Productivity in a Digitalized World

ALI SABYRZHAN<sup>1</sup>, BALDYRGAN JAZYKBAYEVA<sup>2</sup>, MADINA ZHUMABEKOVA<sup>3</sup>,  
ASSEMGUL KAPENOVA<sup>4</sup> (Corresponding author), LYAZZAT DAULETBAYEVA<sup>5</sup>  
and AINURA OMAROVA<sup>6</sup>

<sup>1</sup>Candidate of Economic Sciences, Professor, Institute of Management of the Academy of Public Administration under the President of the Republic of Kazakhstan, Astana, Kazakhstan, email: a.sabyrzhan@apa.kz, ORCID ID: <https://orcid.org/0000-0002-8910-4572>

<sup>2</sup>Associate Professor, Karaganda University of Kazpotrebooyuz, Karaganda, Kazakhstan, email: baldyrgan\_keu@mail.ru, ORCID ID: <https://orcid.org/0000-0003-0738-2526>

<sup>3</sup>Associate Professor, Karaganda University of Kazpotrebooyuz, Karaganda, Kazakhstan, email: m070dfn@mail.ru, ORCID ID: <https://orcid.org/0000-0003-3872-2327>

<sup>4</sup>Associate Professor, Turan-Astana University, Astana, Kazakhstan, email: akapenova@tau-edu.kz, ORCID ID: <https://orcid.org/0000-0002-4425-7815>

<sup>5</sup>Chief Researcher, Karaganda Buketov University, Karaganda, Kazakhstan, email: office@buketov.edu.kz, ORCID ID: <https://orcid.org/0000-0002-8208-6623>

<sup>6</sup>Associate Professor, Karaganda Buketov University, Karaganda, Kazakhstan, email: ainuraphd@mail.ru, ORCID ID: <https://orcid.org/0000-0001-9808-4908>

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#### ABSTRACT

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*Relevance of the Study.* Given the digital transformation of the economy and the growing social importance of healthcare, analyzing the efficiency of financial resource use in the sector and its impact on medical personnel productivity is particularly relevant. Increased government and insurance spending, the introduction of mandatory social health insurance, and the rapid development of digital technologies, including artificial intelligence-based solutions, require a rethinking of traditional approaches to assessing the effectiveness of healthcare financing.

*The aim of the study is to identify and economically substantiate the relationship between healthcare financing and labor productivity in the context of digital technology implementation.*

*The results demonstrate that increased healthcare financing, accompanied by the digitalization of processes and the implementation of AI solutions, contributes to increased labor productivity by reducing unproductive labor costs, streamlining clinical and administrative processes, and more efficient use of human resources. It has been established that, given the limited share of healthcare spending in GDP, the key factor in sustainable growth is improving the efficiency of financial resource use, rather than increasing its quantitative growth.*

*Conclusions.* It is concluded that digital technologies and artificial intelligence are important tools for transforming financial resources into increased labor productivity and the sustainability of the healthcare

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## **INTRODUCTION**

With the accelerated digital transformation of the economy and the growing social significance of healthcare, the issue of the efficient use of financial resources in the sector and their impact on medical personnel productivity is becoming particularly pressing. Increased government and insurance spending on healthcare, the expansion of the range of medical services, the introduction of mandatory social health insurance, and the growing burden on the system as a whole are creating new demands on the quality of financial management and labor productivity. Furthermore, further extensive funding increases are encountering objective macroeconomic constraints, necessitating the search for intensive growth factors based on digital technologies.

The relevance of this study stems from the fact that in recent years, funding for the healthcare system in the Republic of Kazakhstan has demonstrated steady growth and a more complex structure of sources. However, this process is not always accompanied by a proportional increase in labor productivity. Amid a shortage of medical personnel, an increasing administrative burden, and the need to improve the accessibility and quality of medical care, digital technologies, including artificial intelligence-based solutions, are becoming a key tool for transforming financial resources into tangible economic and social impact. However, scientific research still pays insufficient attention to analyzing the relationship between healthcare financing, digitalization, and labor productivity as a systemic economic indicator.

The scientific novelty of this study lies in the development of a comprehensive approach to assessing the impact of healthcare financing on labor productivity, taking into account digital technologies. Unlike traditional studies, which focus primarily on analyzing funding volumes or individual performance indicators, this study examines funding in conjunction with digital transformation and the implementation of AI solutions as a factor determining intensive growth in labor productivity. This novelty also stems from the use of a structural analysis of funding sources (budget, guaranteed volume of free medical care, mandatory health insurance) and the comparison of their dynamics with changes in the volume of services provided and labor productivity indicators.

The practical significance of this study lies in the potential application of the findings in the development of public policy in the area of healthcare financing and digitalization. The results can be used by government agencies, health insurance funds, and heads of healthcare organizations to substantiate priorities for the allocation of financial resources, evaluate the effectiveness of digital investments, and develop measures to improve the productivity of medical personnel. The practical value of the work also lies in the fact that the proposed approaches can serve as a tool for monitoring and predicting the sustainability of the healthcare system in the context of digital technologies.

## **1. RESEARCH METHODS**

The study's methodological framework was developed to comprehensively analyze the impact of healthcare system financing on medical personnel productivity in the context of digital

transformation and the implementation of artificial intelligence technologies. The study utilized a combination of general scientific, economic, and economic-statistical methods to ensure the objectivity and validity of the results.

#### 1) Analysis of scientific literature and regulatory documents

A review of current domestic and international scientific publications, as well as regulatory documents in the field of healthcare financing and digitalization, was conducted. This method allowed us to identify theoretical approaches to assessing the effectiveness of financing, labor productivity, and the role of digital technologies, as well as to determine the main directions of public policy in this area.

#### 2) Systemic and structural-functional approaches

A systems approach was used to examine healthcare as a complex socioeconomic system in which financing, digital technologies, and human capital are interconnected. A structural-functional analysis allowed us to assess the structure of funding sources (budget, guaranteed volume of free medical care, compulsory health insurance) and their functional impact on service volumes and labor productivity.

#### 3) Economic and statistical analysis

This was used to study the dynamics of public healthcare spending, the volume of medical and social services provided, and their growth rates. This method calculated absolute and relative indicators, growth rates, structural shares, and indices, allowing us to identify key trends in the industry's development.

#### 4) Labor productivity analysis

Labor productivity was assessed through the ratio of the volume of services provided to the labor force used, as well as through an analysis of unproductive labor costs. This method allowed us to determine the extent to which the growth in service volumes is achieved through increased staffing or through improved labor efficiency in the context of digitalization.

#### 5) Methods of economic, mathematical, and predictive modeling

To assess the prospects for the development of the healthcare system, a linear forecast of service volumes based on actual growth rates was used. This approach allowed us to determine the potential burden on the system and justify the need to transition from an extensive financing model to an intensive one based on increased labor productivity and the implementation of AI solutions.

#### 6) Comparative Analysis

This was used to compare the dynamics of funding and service volumes across different periods, including the pre-crisis, pandemic, and post-pandemic stages. This allowed us to identify the impact of changes in the funding structure and the level of digitalization on labor productivity.

## 7) Method of Interpreting and Summarizing Results

This was used to formulate conclusions and practical recommendations aimed at improving the efficiency of funding and the implementation of digital technologies in the healthcare system.

## 2. LITERATURE REVIEW

Research into the relationship between healthcare financing and medical personnel productivity occupies a significant place in modern economic and managerial science. Growing public and insurance spending on healthcare, the increasingly complex structure of funding sources, and the simultaneous tightening of demands on the quality and accessibility of medical services have raised the issue of the efficient use of financial resources in the sector. Given limited budgetary and human resources, analyzing the factors that drive rapid productivity growth is particularly important.

Modern research in healthcare economics increasingly views financing not as an end in itself, but as a tool for achieving sustainable results, including increasing the volume and quality of medical services, optimizing costs, and improving labor efficiency. Furthermore, in recent years, the scientific literature has shown increasing interest in the role of digital technologies, including electronic medical systems, big data, and artificial intelligence-based solutions, which have the potential to transform traditional models of healthcare delivery and industry management.

A significant portion of research is devoted to analyzing the impact of digitalization on clinical and management processes, reducing the administrative burden on medical personnel, and increasing the transparency of financial flows. However, most studies examine these aspects fragmentarily—either in the context of technological innovation or from the perspective of funding volumes—without a comprehensive assessment of their combined impact on labor productivity as a key economic indicator.

Therefore, this literature review aims to systematize scientific approaches to assessing healthcare financing, analyzing labor productivity factors, and identifying the role of digital technologies and artificial intelligence in improving the efficiency of financial and human resource use. This approach allows us to identify existing theoretical and empirical gaps, identify areas for further research, and formulate a conceptual framework for analyzing the impact of healthcare financing on labor productivity in a digitally connected world.

Digitalization facilitates accelerated industry development, effective customer interactions, improved service quality, etc. (Al-Dmour et al., 2020), (Tran et al., 2023), (Yang and Masron, 2023). Digital technologies can significantly reduce operational costs and increase efficiency, but require a serious approach to managing new types of risks (Aguayo and Ślusarczyk, 2020). Cocco, Pinna and Marchesi (2017) also confirm these findings in their study, while, like other researchers of blockchain technology, noting cost reduction as one of the factors (Al Shanti and Elessa, 2022). In addition to digital security, in the process of digitalization, healthcare organizations may face other risks, such as operational vulnerabilities, maintaining client privacy, etc. (Chen et al., 2024), (van Zeeland and Pierson, 2024). Globalization, increasing regulation and the increasing role of FinTech companies are prompting organizations to pay special attention to reducing barriers to digitalization implementation (Boot et al., 2020), (Ulrich-Diener et al., 2023).

Management across various industries requires a strategic approach that takes into account key development directions and is essential for achieving competitive advantage and sustainability

(Wang, 2021). L. Qiu, X. Jie, Y. Wang, M. Zhao (2019) and L.A. Suat (2019) argues that innovation in the field of sustainable development has a strong positive relationship with corporate competitiveness, emphasizing that integrating sustainability aspects into companies' activities contributes to their long-term success and competitiveness (El-Kassar et al., 2019).

In the context of modern economic development trends, the use of innovative methods is becoming essential both in technological processes and in the management system of healthcare organizations. At the same time, key emphasis is placed on the financial component of management, since it is the structure and efficiency of financing that determine the feasibility of implementing digital and intelligent solutions. Modern management models should not only improve management forms and methods, but also flexibly adapt to changes in development strategy, ensuring increased labor productivity and sustainable resource use. The implementation of digital technologies with targeted financial support makes the healthcare system more efficient and competitive. For example, integrating supply chains using digital tools optimizes procurement, reduces excess inventory, and expedites the delivery of medical services, thereby reducing operating costs and increasing return on investment. Demand forecasting based on big data analytics facilitates more accurate financial and workforce planning, minimizing inefficient spending and increasing staff productivity. At the same time, digitalization and innovative development stimulate the creation of new medical services and technologies, strengthening the competitiveness of healthcare organizations and improving the efficiency of investment resources.

In this context, the integration of artificial intelligence into the healthcare system of the Republic of Kazakhstan is particularly important. It is becoming a key area of digital transformation and is directly linked to the goal of increasing the productivity of healthcare workers. Amid staff shortages, increasing pressure on the mandatory social health insurance system, and an expanding range of medical services, the use of AI allows for the redistribution of routine and administrative functions, increasing the accuracy and speed of diagnostic decisions, and optimizing the use of material and human resources. As a result, financial investments in AI are transformed into an increase in the specific labor output per employee and a more rational use of the wage fund.

Despite the progress achieved in recent decades, research shows that many countries around the world still have unmet health care needs (leRoux et al., 2020). The most vulnerable groups—rural residents, low-income individuals, and socially disadvantaged groups—continue to face limited access to health services (McGough et al., 2018). These problems increase the burden on the system and require additional financial resources, making the issue of their effective use particularly pressing.

In this regard, an important aspect of managing the modernization of social healthcare infrastructure is ensuring financial sustainability and increasing labor productivity, rather than simply increasing expenditures. Unequal access to health services remains a key element of social inequality in healthcare, which is largely due to the lack of uniform approaches to assessing accessibility and a simplified understanding of this phenomenon in research. Attempts to eliminate access barriers without considering financial and organizational constraints prove insufficient, resulting in access to healthcare remaining a complex and unresolved issue (Roncarolo et al., 2017; Cabrelá-Barona et al., 2017).

Thus, digital technologies and artificial intelligence-based solutions, with adequate funding and effective management, serve as a tool not only for modernizing healthcare but also for

increasing labor productivity, optimizing costs, and reducing inequalities in access to medical services.

An analysis of scientific research and practical approaches suggests that healthcare financing alone does not guarantee increased labor productivity unless accompanied by institutional and technological transformations. Contemporary literature agrees that in the context of the digital economy, it is precisely intensive development factors, primarily digital technologies and artificial intelligence-based solutions, that are becoming the key mechanism for transforming financial resources into sustainable socioeconomic outcomes. At the same time, scientific studies identify a number of systemic issues limiting the impact of funding and digitalization:

- First, a significant portion of the research documents a gap between cost growth and actual labor efficiency, which manifests itself in increased administrative burdens, fragmented digitalization, and duplication of functions;

- Second, uneven digital development across medical organizations and regions is noted, reducing the system-wide impact of technology implementation and exacerbating imbalances in access to medical care;

- Third, the issue of personnel and organizational readiness remains insufficiently addressed: without developing digital competencies among personnel and process reengineering, even modern AI solutions will not deliver the expected increases in labor productivity.

An additional problem is that a number of studies consider labor productivity indirectly—through service volumes or funding indicators—without directly linking it to labor time expenditure, employment structure, and the quality of medical personnel. This complicates the development of universal models for assessing the effectiveness of financing in the context of digital technologies.

According to the author, the further development of the healthcare system should be based not on an extensive expansion of financial resources, but on a qualitative change in the mechanisms for their use. Funding for digital technologies and AI solutions should be viewed as investments in increasing labor productivity, rather than as a separate expense item. Priority should be given to those digital initiatives that directly reduce unproductive labor costs, optimize clinical and administrative processes, and increase the return on human capital.

From a public policy perspective, this implies a transition to a performance-based financing model in which digital investments are assessed based on their contribution to increased labor productivity, system sustainability, and the reduction of inequalities in access to healthcare services. This approach allows us to create an economically sustainable, technologically advanced, and socially oriented healthcare model that meets the challenges of the digital age.

### **3. ANALYSIS AND RESULTS**

The integration of artificial intelligence into the healthcare system of the Republic of Kazakhstan is becoming not only a key area of digital transformation but also a tool for improving the efficiency of financial resources in the sector, directly impacting the productivity of healthcare workers. Amidst a labor shortage, increasing burden on the mandatory social health insurance system, and an expanding range of medical services, the quality and structure of healthcare financing are becoming crucial for the implementation of digital technologies capable of ensuring rapid productivity growth.

Targeted funding for AI solutions enables the redistribution of routine and administrative functions, increases the accuracy and speed of diagnostic decisions, and optimizes the use of material and human resources. As a result, financial investments in digital technologies translate into increased productivity per healthcare worker, ensuring more efficient use of budget and insurance funds and enhancing the sustainability of the healthcare system as a whole (Table 1).

**Table 1.** Areas of funding for AI solutions in healthcare

	Direction	Application
1	The use of AI in radiology and imaging diagnostics (CT, MRI, X-ray, mammography)	Computer vision algorithms help automatically detect pathological changes and early stages of oncological and cardiovascular diseases, reducing the time it takes to interpret examinations and increasing the accuracy of conclusions, allowing radiologists to focus on complex cases, consulting with clinicians and interdisciplinary collaboration, and reducing the risk of diagnostic errors.
2	Clinical decision support systems (CDSS) - an intelligent decision support system	Based on an analysis of medical records, patient histories, and laboratory data, they generate diagnostic guidelines, treatment options, and complication prevention. In Kazakhstan, such solutions are particularly relevant at the regional and district hospital level, where there is a shortage of specialized specialists and a high workload for general practitioners.
3	Applying AI to Patient Flow and Resource Management	Hospitalization forecasting, bed planning, and smart patient routing between levels of care (primary care, district, regional hospitals, and national centers). Machine learning models analyze disease seasonality, demographic structure, and department workload, reducing waiting lists, more evenly distributing staff workload, and reducing unscheduled overtime, thereby increasing productivity and reducing the risk of burnout.
4	AI solutions in telemedicine and chronic patient monitoring	Remote monitoring systems, wearable data analysis, and automatic alerts about risk factors for deteriorating conditions (for example, cardiovascular disease and diabetes) can reduce the number of preventatively “missed” cases and reduce the volume of emergency care.
5	AI in drug supply and logistics management	Forecasting the need for medications and consumables, optimizing procurement and inventory, and identifying spending anomalies. This directly impacts the efficient use of budget funds and the productivity of administrative and management personnel.
6	AI in HR Analytics and Healthcare Workforce Management	Assessing personnel risks, planning workloads, modeling shift distribution scenarios, identifying factors that contribute to burnout and turnover—allows for more sustainable work schedules, increasing employee satisfaction and, consequently, productivity.
7	Assessment of the quality of medical services and ESG analytics in healthcare	Based on large data sets (volume of services provided, financing structure, complaints, safety indicators, data on resource consumption and waste), integrated indicators of the effectiveness and sustainability of healthcare organizations are formed, creating the basis for risk-scores in ESG areas and scenario analysis, which makes it possible to assess how changes in the structure of services, digitalization of processes or investments in energy efficiency will affect the quality of care, the workload of personnel and financial stability.

Source: compiled by the authors

According to the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, in the first quarter of 2025, the volume of services provided by healthcare organizations in the country amounted to 832,323.4 million tenge, which is 15.6% higher than the first three months of 2024, when the volume of healthcare services provided amounted to 719,830.8 million tenge.

Funding in the first quarter of 2025 was provided by the following sources:

- budget funds – 267,876.8 million tenge (32.2%),
- household funds – 178,981.4 million tenge (21.5%),
- enterprise funds – 82,581.8 million tenge (9.9%),
- funds from the Social Health Insurance Fund (SHIF) – 302,883.3 million tenge (36.4%).

Hospital services accounted for the largest volume of services – 391,575.9 million tenge, or 47% of the total. Of this amount, 158,797.8 million tenge came from the budget, 39,442.2 million tenge came from individuals, 20,046.8 million tenge came from businesses, 173,289.2 million tenge came from the Compulsory Medical Insurance Fund.

Analysis of the healthcare spending structure allows us to identify funding priorities and determine the areas where the system's primary financial burden is concentrated. A significant share of expenditures goes toward medical personnel salaries and associated administrative costs, making the efficient use of financial resources a key factor in the industry's sustainability. With the volume of services growing and budget and insurance funding limited, improving labor productivity is becoming essential for optimizing the cost structure.

In this context, funding digital technologies and artificial intelligence-based solutions is of strategic importance. Targeted investments in AI can reduce unproductive labor costs, optimize administrative and clinical processes, and reallocate costs in favor of increasing the productivity of healthcare workers. The structure of healthcare service expenditures in the first quarter of 2025 is presented in Table 2.

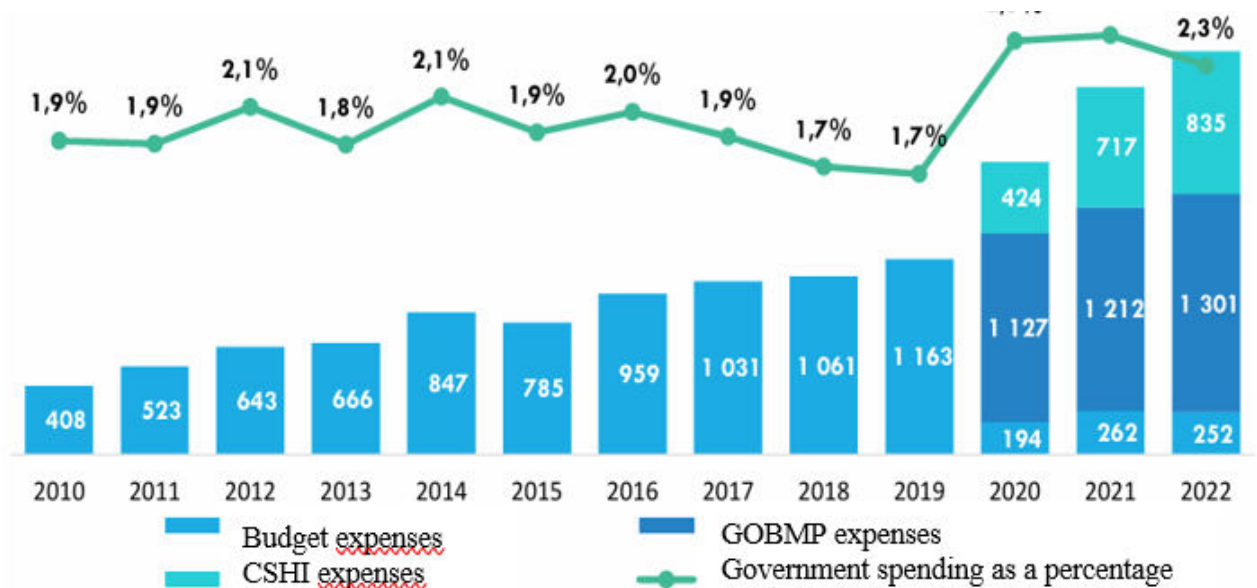
**Table 2.** Structure of expenditure on healthcare services in the first quarter of 2025

Expenses, thousand tenge	Q1 2025, total	Including at the expense of funds			
		Budget	Population	Enterprises	Social Health Insurance Fund
Total number of healthcare services provided	832 323 378	267 876 838	178 981 432	82 581 796	302883313
Including:					
Hospital services	391 575 941	158 797 804	39 442 154	20 046 829	173 289154
Services of hospital surgical departments	59 400 004	26 897 856	3 852 115	1 327 669	27 322 363
Services of gynecological departments of hospitals and maternity homes	41 524 691	17 849 988	2 145 051	2 249 220	19 280 432
Rehabilitation center services	18 364 802	6 757 928	4 680 829	3 458 793	3 467 252
Psychiatric hospital services	13 879 521	7 122 596	1 396 382	189 206	5 171 337
Other hospital services provided under the supervision of physicians	40 525 560	13 394 052	3 358 335	1 511 237	22 261 936
Services of other hospitals	217 881 363	86 775 384	24 009 442	11 310 704	95 785 833
Services in the field of general medical practice	174 189 659	51 460 603	32 922 926	19 776 968	70 029 162
Services in the field of specialized medical practice	61 948 882	11 091 192	20 250 829	5 994 185	24 612 676
Dental services	60 125 272	1 553 874	52 342 557	2 015 067	4 213 775
Other human health services	144 483 624	44 973 365	34 022 966	34 748 747	30 738 547

Source: compiled by the authors according to <https://www.stat.gov.kz>

Transforming the cost structure through the implementation of AI not only contributes to increased labor productivity but also to a more efficient use of healthcare system resources, including budgetary allocations and mandatory social health insurance resources.

The profound underfunding of Kazakhstan's free healthcare system is clearly evident in comparison with developed OECD countries. The level of public spending on healthcare relative to GDP in Kazakhstan is more than three times lower than the OECD average (Figure 1).



**Figure 1.** Government Expenditures by Source of Funding, in billion tenge  
Source: compiled by the authors according to <https://halykfinance.kz/>

According to Figure 1:

- the share of the compulsory health insurance system is growing significantly (from 24.3% to 35.0%), indicating a stronger role for insurance financing;
- the guaranteed free medical care remains the largest source (~54–65%), which is logical for the basic guaranteed package;
- the "budget" component in the overall structure is approximately 10–12%

Structure of funding sources (shares), 2020–2022 (in 2010–2019, the budget share = 100% according to the presented graph) (Table 3).

**Table 3.** Structure of funding sources (shares), 2020–2022

Year	Budget, billion tenge	State Fund for Free Medical Care, billion tenge	Compulsory health insurance, billion tenge	Total, billion tenge	Budget share, %	Share of guaranteed volume of medical care, %	Share of compulsory health insurance, %
2020	194	1127	424	1745	11,1	64,6	24,3
2021	262	1212	717	2191	12,0	55,3	32,7
2022	252	1301	835	2388	10,6	54,5	35,0

Source: own

Until 2019, growth was generally moderate/wave-like, with the share of GDP remaining around 1.7–2.1%. In 2020–2021, there was a sharp jump in total financing (+50% and +25.6%), while the share of GDP rose to 2.5–2.6%. In 2022, growth slowed to ~9%, and the share of GDP decreased to ~2.3% (Table 4).

**Table 4.** Dynamics of total volume and growth rates (YoY), as well as share in GDP

Year	Total expenses, billion tenge	Growth rate compared to the previous year, %	Government spending as a percentage of GDP
2010	408	-	1,9
2011	523	28,2	1,9
2012	643	22,9	2,1
2013	666	3,6	1,8
2014	847	27,2	2,1
2015	785	-7,3	1,9
2016	959	22,2	2,0

2017	1031	7,5	1,9
2018	1061	2,9	1,7
2019	1163	9,6	1,7
2020	1745	50,0	2,5
2021	2191	25,6	2,6
2022	2388	9,0	2,3

Source: compiled by the authors

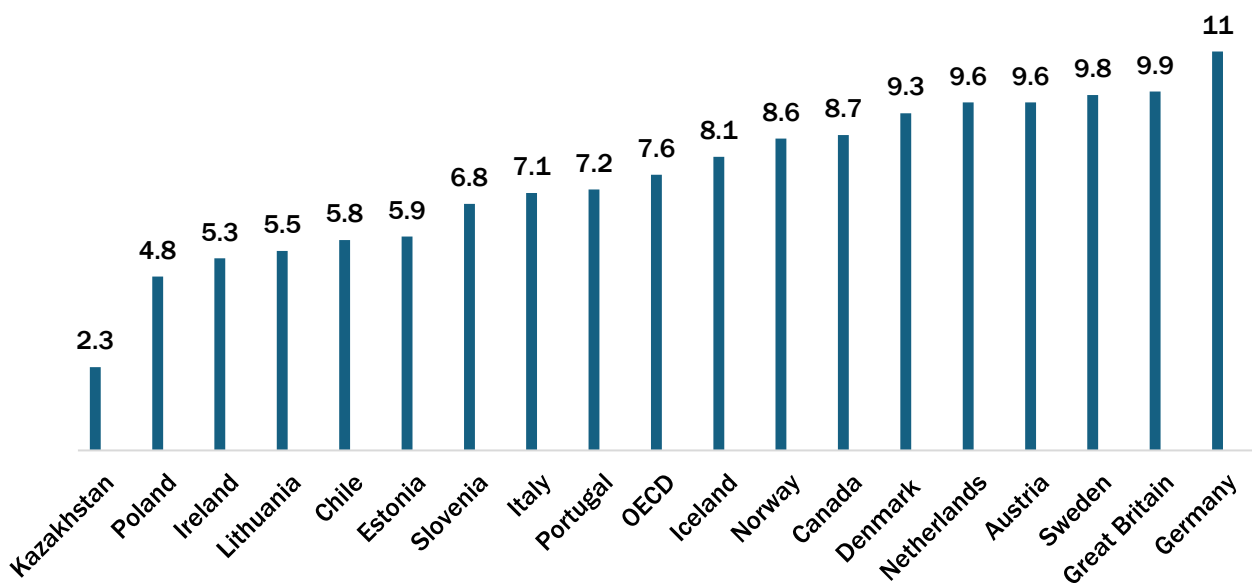
Overall, the healthcare system in Kazakhstan is financed largely by public expenditures – 62.0%:

- State budget expenditures – 40.1% of current healthcare expenditures;
- Expenditures in the compulsory health insurance system – 21.6% of current healthcare expenditures.

Private expenditures account for 38% of current healthcare expenditures. Of these:

- Out-of-pocket payments – 30.9%;
- Voluntary health insurance expenditures – 1.0%;
- Employer expenditures (company payments for their employees) – 5.9%;
- Expenditures of non-profit organizations – 0.4%.

According to WHO recommendations, for a properly functioning system with budget financing, the minimum level of healthcare expenditures should be 6–9% of GDP in developed countries and at least 5% of GDP in developing countries (Figure 2).



**Figure 2.** Public Healthcare Expenditures as a % of GDP in OECD Countries

Source: compiled by the authors according to <https://halykfinance.kz/>

Targeted funding for digital infrastructure and information security ensures the reliability and continuity of management and clinical processes, reducing the risk of failures and data leaks that can lead to additional financial losses. At the same time, investments in developing the digital competencies of medical and management personnel increase the return on investment, ensuring the effective use of information systems and artificial intelligence technologies.

Currently, the healthcare management system is undergoing a digital transformation, including the development of information and communications infrastructure based on new technologies, strengthening information security, and developing the digital skills and competencies of personnel. The implementation of these processes directly depends on the structure and priorities of healthcare financing, as the implementation and maintenance of digital solutions require sustainable budgetary and insurance sources, as well as targeted investment programs (Table 5).

**Table 5.** Volume of services in the field of healthcare and provision of social services, thousands of tenge

Total	3rd quarter	
	2024	2025
Healthcare services provided	896 710 178	921 454 441
Services provided in the field of social services with accommodation	34 488 265	41 904 271
Services provided in the field of social services without provision of accommodation	14 132 327	15 817 147

Source: compiled by the authors according to [https:// www.stat.gov.kz](https://www.stat.gov.kz)

Digital management transformation serves not only as a technological but also as a financial and economic tool, enabling increased cost effectiveness, labor productivity, and the sustainability of the healthcare system in the digital age.

Analysis of the data in Table 3 reveals a steady increase in the volume of healthcare and social services provided. In the third quarter of 2025, the volume of healthcare services increased to 921.5 billion tenge, compared to 896.7 billion tenge in 2024, reflecting expanded medical activity and increased demand for services. Similar dynamics are observed in the social services sector:

- services with accommodation increased from 34.5 billion to 41.9 billion tenge,
- services without accommodation increased from 14.1 billion to 15.8 billion tenge.

The growth in all categories indicates expanded population coverage, improved process manageability, and the growing role of digital solutions. The increase in the volume of healthcare services provided is directly linked to the industry's active digital transformation, supported by budget and insurance funding, as well as targeted investments in digital technologies and artificial intelligence-based solutions. Given limited financial and human resources, digital tools are becoming a driver of intensive growth, ensuring increased medical staff productivity without a proportional increase in costs.

- First, increased accessibility and speed of service delivery has been made possible by the implementation of digital medical platforms, electronic queuing systems, telemedicine, and mobile patient apps. Funding for these solutions has reduced transaction costs for the healthcare system, shortened wait times, and increased the capacity of medical organizations. As a result, with comparable funding levels, an increase in the number of patients served is achieved, which is reflected in an increase in the specific output per medical worker.

- Second, increased medical staff productivity is achieved through the automation of routine and administrative operations, the implementation of electronic medical records, the integration of laboratory and diagnostic systems, and the use of AI solutions to support clinical and

management decisions. Targeted investments in digitalization allow for the reallocation of physician and nursing staff time toward clinical activities, reducing unproductive labor costs and increasing the efficiency of payroll use.

An important financial and economic benefit of digitalization is increased transparency and accountability in the use of funds, achieved through digital monitoring of medical care quality indicators, patient satisfaction, the publication of open data, and the functioning of feedback systems. This helps reduce errors, improve clinical outcomes, and strengthen public trust in the healthcare system, while also increasing the efficiency of budget and insurance resource allocation. Furthermore, digital technologies and AI solutions help reduce operating costs, as electronic services reduce the need for paperwork, optimize administrative processes, and allow for the forecasting of human and material resource requirements. This reduces the risk of inefficient use and increases the return on investment.

- Third, digital transformation has strengthened coordination between healthcare organizations, ensuring the rapid exchange of data between medical institutions, laboratories, insurance funds, and government information systems. Improving the efficiency of patient routing, accelerating high-tech procedures, and simplifying access to comprehensive medical services enable the healthcare system to deliver greater volumes of services at the same or lower costs, which directly impacts productivity growth and the sustainability of sector financing.

To assess the prospects for the development of the healthcare and social sector, a simple linear forecast of service volumes was conducted based on actual growth rates for 2024–2025. This approach not only identifies short-term dynamics but also correlates projected changes with the sector's funding capacity and potential productivity growth in the context of digital transformation.

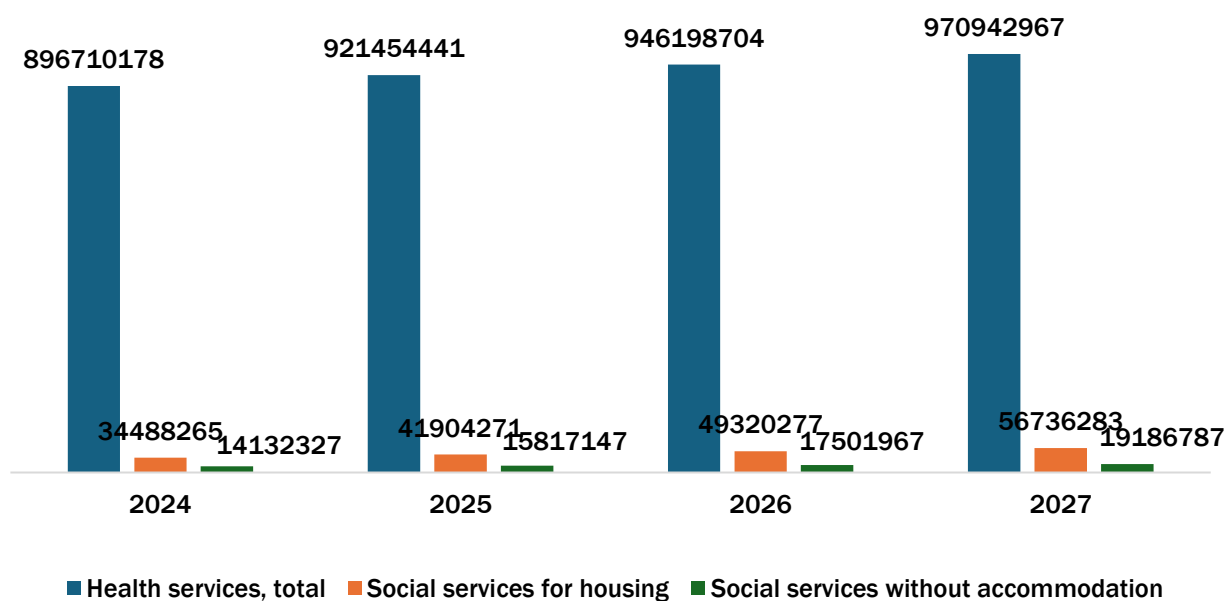
The growth in service volumes in healthcare and social services was stable even before 2024, driven by expanded medical coverage, the introduction of electronic services, and increased spending through budget and insurance financing (Table 6).

**Table 6.** Volume of services in healthcare and social sphere

Year	Health services, total	Social services with accommodation	Social services without accommodation
2019	620 540 000	18 945 000	9 874 000
2020	701 382 000	22 318 000	11 402 000
2021	768 495 000	26 741 000	12 965 000
2022	823 610 000	30 582 000	13 874 000
2023	861 294 000	33 901 000	14 052 000
2024	896 710 178	34 488 265	14 132 327

Source: compiled by the authors according to [https:// www.stat.gov.kz](https://www.stat.gov.kz)

The increase in service volumes was accompanied by increased funding for the healthcare system, primarily through budgetary allocations and mandatory social health insurance funds. However, while traditional organizational models remained in place, this growth led to increased workloads for staff and rising costs. Based on the growth rates for 2024–2025, a linear forecast was calculated, as shown in Figure 3.



**Figure 3.** Linear forecast based on the 2024–2025 growth rate of the volume of healthcare and social services

Source: Compiled by the authors

The forecast shows steady growth across all areas. To correlate this with funding, it's convenient to add growth rates and structural shares within the overall volume of services (healthcare vs. social services) (Table 7).

**Table 7.** Growth rates and structure of the projected volume of services

Year	Health services, total	Social services with accommodation	Social services without accommodation	Total services (amount), units
2024	896710178	34488265	14132327	945330770
2025	921454443	41904271	15817147	979175859
2026	946198704	49320277	17501967	1013020948
2027	970942967	56736283	19186787	1046866037
Year	Total growth rate, %	Share of healthcare, %	Share of social services with accommodation, %	Share of social services without accommodation, %
2024	-	94,86	3,65	1,49
2025	3,58	94,10	4,28	1,62
2026	3,46	93,41	4,87	1,73
2027	3,34	92,74	5,42	1,83

Source: compiled by the authors

Rising government spending and the increasingly complex healthcare financing structure (the strengthening of the role of the guaranteed volume of medical care and the mandatory health insurance system in 2020–2022) reflect the expanding system's obligations and increased demands for resource efficiency. Against this backdrop, the forecast for service volume for 2024–2027 demonstrates steady growth, implying a further increase in the burden on medical personnel and infrastructure. Consequently, maintaining the pace of service expansion while limiting expenditures as a share of GDP objectively requires a shift in focus toward increasing labor

productivity through digitalization and the implementation of AI solutions that reduce unproductive labor costs and optimize clinical and administrative processes.

The resulting forecast demonstrates a steady upward trend in all three areas, which is logically interpreted as the result of:

- expanding the range of medical and social services;
- deepening the integration of medical and social care;
- continuing digital transformation of the industry. The growth in the volume of services provided is directly linked to increased financial flows into the healthcare system. However, the projected dynamics point to an important structural shift: further expansion of services is impossible solely through increased expenditure. Given limited budgetary and insurance resources, increasing the productivity of medical personnel becomes a key factor.

It is in this context that digital technologies and artificial intelligence-based solutions acquire strategic importance. Their implementation, with comparable funding levels, allows for:

- serving a greater number of patients;
- reducing administrative and transaction costs;
- increasing the specific output per employee.

Therefore, the projected growth in service volumes should be viewed not only as a quantitative expansion of the system, but also as an indicator of the need to transition to an intensive development model based on digitalization, AI, and more efficient use of financial and human resources.

## CONCLUSION

The study concluded that the effectiveness of the healthcare system in the current environment is determined not so much by the volume of funding as by the quality of its use and the degree of digital transformation in the industry. An analysis of the dynamics and structure of funding revealed that in recent years, the Republic of Kazakhstan has seen a steady increase in government and insurance spending on healthcare, accompanied by a more complex set of funding sources and an expanded range of medical and social services. However, increased financial resources do not always lead to a proportional increase in the productivity of medical personnel.

Amid a labor shortage, an increasing burden on the mandatory social health insurance system, and limitations on the share of healthcare expenditures in GDP, further development of the sector requires a transition from an extensive model based on increasing expenditures to an intensive growth model, a key element of which is increasing labor productivity. It has been established that digital technologies and artificial intelligence-based solutions are an important tool for this transformation, helping to reduce unproductive labor costs, optimize clinical and administrative processes, and increase the return on human capital. The results of the analysis and forecasting of service volumes indicate the continued upward trend in healthcare and social services in the medium term. This objectively increases the requirements for the efficient use of financial resources and emphasizes the need to integrate digital and AI solutions into the sector's management system. The implementation of such technologies allows for an increase in the volume and quality of services, while simultaneously increasing the productivity of medical personnel, with comparable funding levels.

Overall, it is concluded that healthcare financing in the context of digital technologies should be viewed as an investment in increasing productivity and system sustainability, rather than as a

collection of operating expenses. A comprehensive combination of targeted funding, digitalization of management and clinical processes, and the development of digital competencies among personnel forms the basis for increased efficiency, reduced inequalities in access to medical services, and the long-term socioeconomic development of the healthcare system in the Republic of Kazakhstan.

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