Optimization of the Outpatient Pharmaceutical Supply System in the Republic of Kazakhstan

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ABSTRACT

The development of Kazakhstan's healthcare system at the current stage necessitates a comprehensive revision of approaches to outpatient pharmaceutical provision (OPP), which represents a key instrument for enhancing the efficiency and accessibility of medical care. OPP plays a central role in the implementation of national pharmaceutical policy by ensuring the availability of essential medicines and medical products within the framework of the Guaranteed Volume of Free Medical Care (GVFMC) and the Mandatory Social Health Insurance system (MSHI).

This study employed statistical, comparative, and content analysis methods, expert evaluation techniques, as well as pharmacoeconomic modeling tools (ABC/VEN, QALY/DALY). The findings reveal substantial interregional disparities in patient coverage, misalignment between procurement volumes and actual population needs, and an insufficient level of digitalization and interoperability of information systems.

The paper proposes several optimization directions, including the application of predictive algorithms for procurement planning based on epidemiological indicators and QALY/DALY models, the enhancement of digital logistics monitoring, the establishment of regional reserves of essential medicines, and improved transparency of budget planning.

KEYWORDS: outpatient pharmaceutical provision, pharmaceutical policy, pharmacoeconomic analysis, optimization, Kazakhstan, rational use of medicines, healthcare system.

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INTRODUCTION

Relevance.

Outpatient pharmaceutical provision (OPP) represents one of the foundational components of Kazakhstan's healthcare system, directly influencing access to pharmacotherapy and the rational use of public financial resources [1]. The effectiveness of OPP determines the overall quality of healthcare delivery and ensures equity in access to medicines [2].

In recent years, several reforms have been implemented to strengthen the system: centralized pricing mechanisms, enhanced control of procurement processes, and the introduction of digital platforms such as "Pharmaceutical Provision" and the "Electronic Register of Dispensary Patients." However, despite the visible progress, several systemic issues persist, including duplication of requests submitted by medical organizations, the absence of a unified forecasting system for medicinal demand, and the low level of automation in prescription and dispensing processes.

These shortcomings pose risks of supply interruptions and threaten continuity of treatment for patients with chronic conditions. International evidence (WHO, OECD, EU) indicates that effective pharmaceutical provision must be grounded in the principles of rational use of medicines, economic efficiency, and transparency. For Kazakhstan, this becomes particularly relevant given population aging, the rising burden of chronic diseases, and the growing share of pharmaceutical expenditures in the national healthcare budget [3].

An analysis of pharmaceutical procurement dynamics across priority nosologies for the period 2014–2025 demonstrates a steady increase across all major therapeutic categories, reflecting an expansion of state-funded programs and adaptation to evolving epidemiological trends. Total procurement volume grew from 50 billion KZT in 2014 to a projected 89 billion KZT in 2025.

Oncological diseases maintain the highest share of procurement expenditures, reflecting national prioritization of costly specialized therapies, including targeted and biological agents.

Diabetes mellitus shows a consistent upward trend, particularly after 2017, driven by a broader range of insulin analogues and rising disease prevalence.

Cardiovascular diseases exhibit stable funding, although growth rates lag behind other categories despite their high morbidity and mortality burden.

Tuberculosis demonstrates a gradual decline in procurement share, possibly associated with reduced incidence and a strategic shift toward other priority disease areas.

Antiinfective medicines and vaccines exhibit a sharp surge in 2020 (during COVID-19), followed by stabilization at a higher baseline level, reflecting strengthened preventative health policies.

Other nosologies, including rare and orphan diseases, continue to account for a substantial portion of the budget, underscoring the need for more targeted and patient-specific resource allocation.

Overall, pharmaceutical procurement by nosology in Kazakhstan has become more balanced over the past decade; however, challenges remain in pharmacoeconomic justification of procurement decisions, prioritization of expenditures, and ensuring logistical resilience of supply chains.

MATERIALS AND METHODS

The study utilized official statistical reports of the Ministry of Healthcare of the Republic of Kazakhstan for 2015–2024, data from the Bureau of National Statistics, yearly OPP reports for 2022–2024, datasets from the Unified Distributor, and international databases including the World Bank, Health System Tracker, and Report Linker. Scientific publications examining hospital bed utilization efficiency and pharmaceutical provision systems were also reviewed.

A comprehensive methodological approach was applied. Retrospective statistical analysis was used to evaluate trends in epidemiological indicators and healthcare resource allocation. Correlation analysis was employed to assess the relationship between levels of pharmaceutical coverage and mortality indicators for priority nosologies. Pharmacoeconomic evaluation based on DALY and QALY metrics enabled the assessment of cost-effectiveness of procured medicines. Additionally, regional analysis of hospital bed availability and access to pharmaceuticals was conducted to identify interregional disparities and determinants of accessibility of medical and pharmaceutical services.

RESULTS

Pharmaceutical provision requires a complex and systematic approach, as it reflects the real accessibility of therapy for the population within the GVFMC and MSHI programs [4]. Under conditions of limited financial resources, medicine supply must ensure not only continuity but also prioritization based on clinical and economic justification (Figure 1).

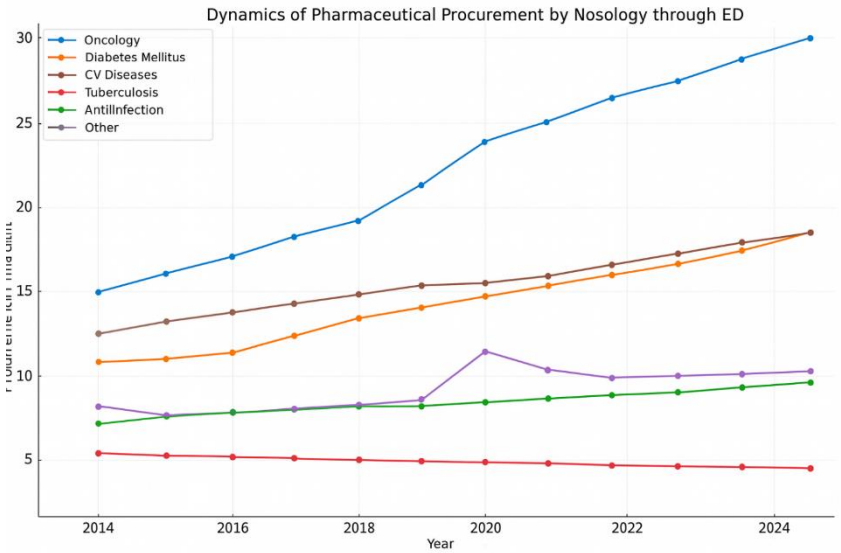

Figure 1 - Dynamic Trends in Pharmaceutical Procurement for Priority Nosologies, 2014-2025

The analysis of the collected data indicates that the outpatient pharmaceutical provision system in Kazakhstan is undergoing active development, yet continues to face several structural and managerial challenges. The average level of patient coverage in 2022–2024 amounted to approximately 62% of all individuals registered for dispensary monitoring. At the same time, pronounced interregional disparities were observed:

The highest patient load per medical facility was recorded in the North Kazakhstan Region (≈ 7.5 thousand patients), Almaty Region (≈ 6 thousand), and Kyzylorda Region (≈ 5.8 thousand).

The lowest load was noted in Atyrau and Mangystau Regions (2–3 thousand patients), reflecting imbalances in staffing and resource distribution.

Coverage rates also varied across state programs:

- within the GVFMC framework - about 40%,
- within MSHI for adults - 46%,
- for children - up to 79%.

Chronic and rare diseases- including oncological, hematological, and metabolic disorders- remain the most problematic categories in terms of coverage and financial burden. The analysis shows that in 2023, the majority of budget expenditures were driven by chronic and orphan diseases. The highest spending was associated with the treatment of diabetes mellitus and oncohematological conditions, owing to their high prevalence and the use of costly innovative therapies.

A substantial share of expenditures was also attributed to orphan diseases, such as mucopolysaccharidoses, coagulation factor deficiencies, and spinal muscular atrophy, all characterized by extremely high per-patient treatment costs. Collectively, the expenditure structure highlights the dominance of nosologies requiring long-term, high-cost treatment, which in turn shapes the priorities of financial planning within the national healthcare system (Figure 2).

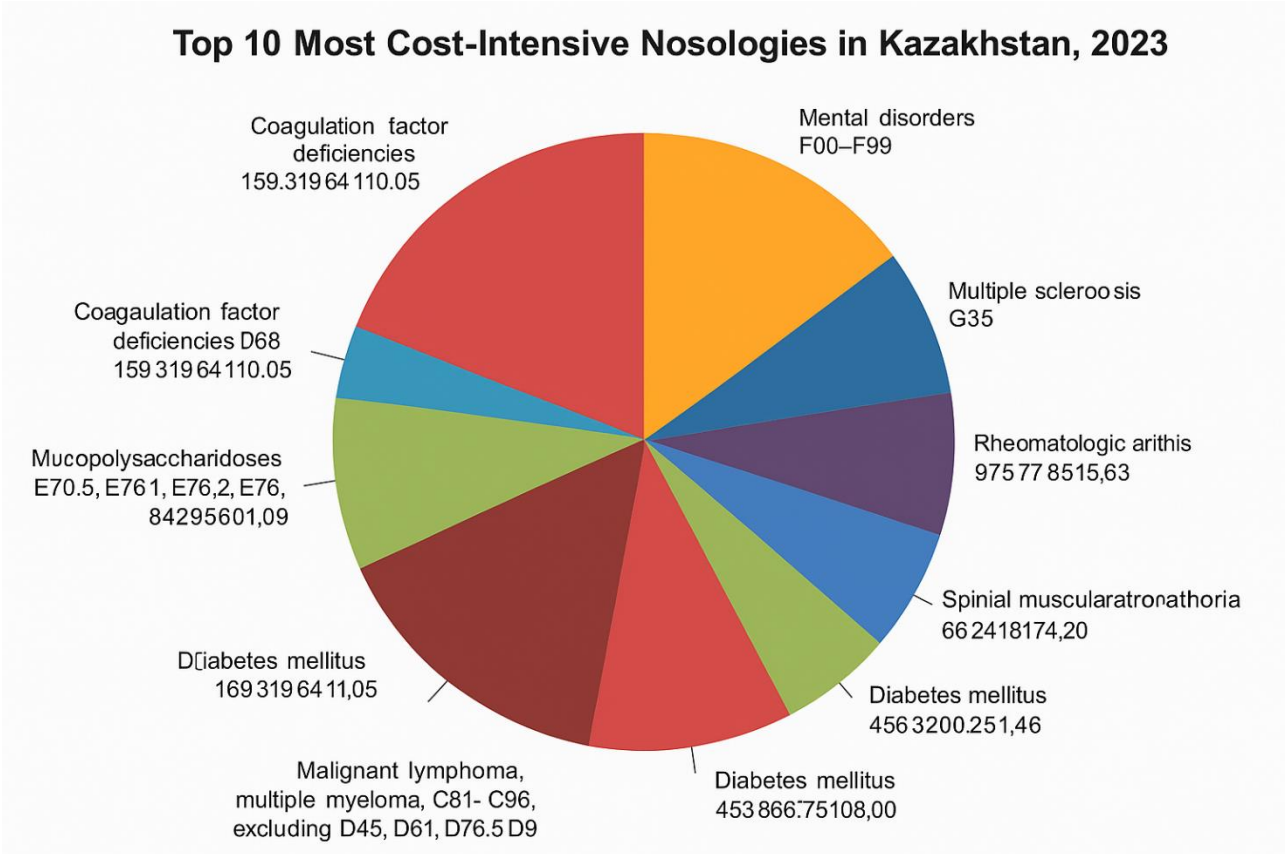

Figure 2. Structure of High-Cost Nosologies within Outpatient Pharmaceutical Provision in the Republic of Kazakhstan

Despite the overall increase in funding (from approximately 40 to 80 billion KZT over the decade), the procurement structure remains imbalanced: a substantial share of the budget continues to be concentrated on high-cost nosologies (e.g., oncology, diabetes), whereas cardiovascular and other non-communicable diseases remain comparatively underfunded (Table 1).

An analysis of data from the Unified Distributor and the Ministry of Healthcare of the Republic of Kazakhstan indicates a significant rise in expenditures for the treatment of oncological diseases (+191%), diabetes mellitus (+175%), infectious diseases (+200%), and cardiovascular diseases (+70%) during 2014–2025. This trend reflects both the growing disease burden

and the introduction of costly therapeutic technologies.

At the same time, a decrease in funding for tuberculosis treatment (–28%) is observed, indicating favorable epidemiological progress.

Table 1. Forecast Based on Data from the Unified Distributor and the Ministry of Healthcare of the Republic of Kazakhstan

Diagnostic Group	2014 y. (billion KZT)	2020 y. (billion KZT)	2025 y. (forecast, billion KZT)	Change (%)
Oncological diseases	12	24	35	+191%
Diabetes mellitus	8	15	22	+175%
Cardiovascular diseases	10	14	17	+70%
Tuberculosis	7	6	5	–28%
Infectious diseases (including COVID-19)	3	10	9	+200%

With the implementation of the Mandatory Social Health Insurance System, the primary task of the Fund, acting as a strategic purchaser, is the optimization of hospital bed capacity in accordance with the regional structure of hospitalized morbidity [5]. Pharmaceutical supply must align with the actual epidemiological situation [6]. However, the relationship between disease outbreaks (ARVI, COVID-19, acute intestinal infections) and the procurement of antiviral/antibacterial medicines remains insufficiently defined.

For example, in 2023–2024, an increase in infectious morbidity was observed following large-scale floods, while vaccine procurement was carried out on an unplanned basis from budget reserves. In the first half of 2024, the Government allocated an additional 5.8 billion KZT for the procurement of vaccines (diphtheria, hepatitis, measles, rubella) in response to emerging public health threats.

At the current stage, there is no system of integrated assessment of the effectiveness of procured medicines based on DALY/QALY metrics. Meanwhile, international practice requires that public pharmaceutical procurement be grounded not only in clinical justification but also in economic efficiency (the cost per QALY gained should not exceed a defined cost-effectiveness threshold) (Table 2).

Table 2 - Analysis of the Cost-Effectiveness of Procured Medicines Based on DALY/QALY Metrics

Medicine	Indication	Course Cost (KZT)	QALY Gain	Cost per QALY (KZT)	Conclusion
Sunitinib	Oncology	1 200 000	0.7	1 714 285	Conditionally acceptable
Insulin glargine	Type 1 diabetes	200 000	0.9	222 222	Highly effective
Ribavirin	Hepatitis C	900 000	0.4	2 250 000	Questionable effectiveness
Source: compiled by the authors					

There are critical risks associated with the timeliness of deliveries and the logistical resilience of supply chains, particularly at the regional level [7]. Integrating pharmacoeconomic indicators into procurement planning processes is essential. It is recommended to strengthen the analytical component by structuring needs by nosology and incorporating data on shortages, logistics performance, epidemiological trends, and QALY-based assessments [8].

Particular attention in the analysis was given to the provision of medicines for patients with diabetes mellitus—one of the most financially burdensome and socially significant nosologies within the outpatient pharmaceutical provision system [9, 10].

Based on the results of our data analysis, the following issues were identified in the pharmaceutical provision for patients with diabetes mellitus:

- Regional disparities in coverage. Expenditures per diabetic patient vary more than twofold: from approximately 67,000 KZT in the Aktobe Region to about 150,000 KZT in Almaty. These differences cannot be attributed solely to disease prevalence, indicating weaknesses in planning and oversight mechanisms (Figure 3).

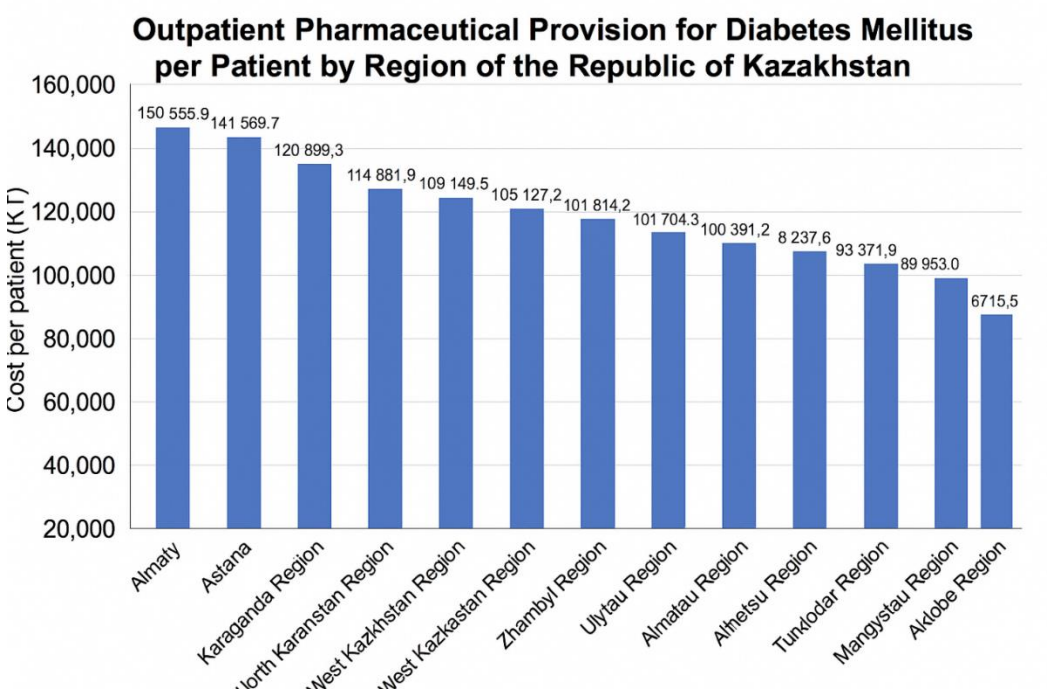

Figure 3. Outpatient Pharmaceutical Expenditures for Diabetes Mellitus per Patient by Region of the Republic of Kazakhstan

- Shift in procurement structure. In 2023–2024, the share of modern non-insulin therapies-SGLT-2 inhibitors and GLP-1 receptor agonists—increased, while the proportion of insulin preparations declined. This trend necessitates a comprehensive clinical and economic assessment and a revision of procurement priorities considering long-term effectiveness.
- Irrational prescribing practices. Several regions demonstrated treatment regimens inconsistent with clinical guidelines (e.g., GLP-1 + DPP-4 combinations, or insulin + repaglinide). These practices affected approximately 31,000 patients and resulted in excessive expenditures of around 1.7 billion KZT. This indicates insufficient clinical oversight and a lack of automated tools for prescription validation.
- Organizational and digital gaps. The insulin pump program for children aged 0-18 shows positive clinical outcomes; however, its implementation is hindered by the absence of a single administrative body, standardized pricing frameworks, and transparent registries of devices and consumables (Figure 4).

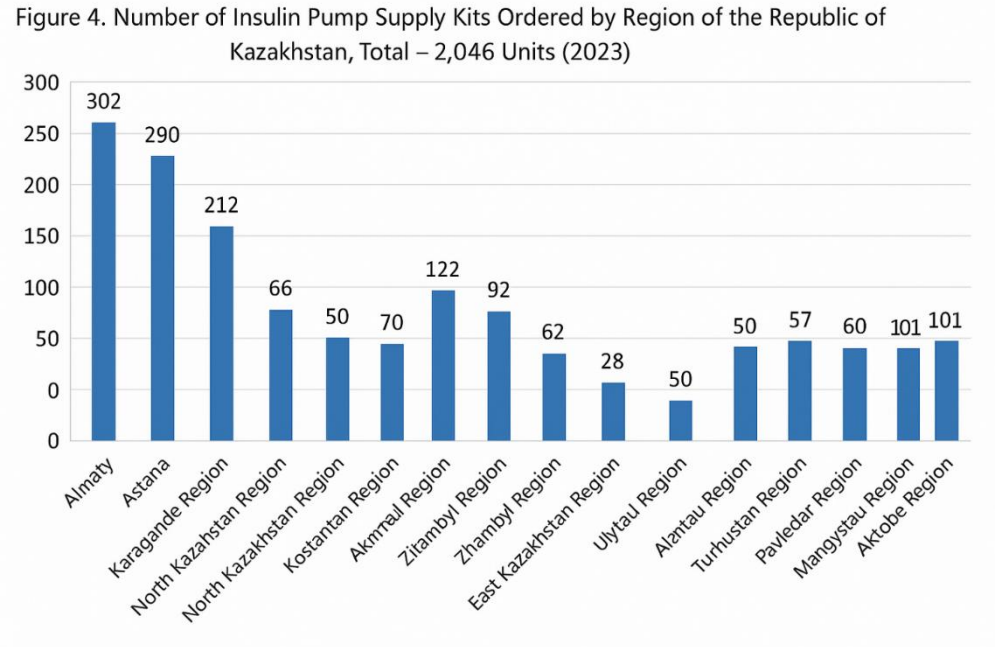

Figure 4. Estimated Number of Insulin Pumps in the Republic of Kazakhstan by Region, 2023

Fragmentation of information systems remains a critical challenge. The "Pharmaceutical Provision" system, the Unified Healthcare Information System (EHIS), and the Electronic Register of Dispensary Patients (ERDP) operate independently, which prevents comprehensive tracking of medicine movement from request submission to dispensing, as well as real-time monitoring of expenditure efficiency and stock levels.

These factors contribute to the irrational use of financial resources and unequal access to therapy. Addressing these issues requires the integration of pharmacoeconomic criteria into procurement planning and the development of a unified digital framework enabling end-to-end monitoring across the entire chain: request – procurement – dispensing – patient.

In addition, the identified cases of irrational prescribing underline the need to introduce an automated validation and logical control system during prescription issuance. Such a system should verify dosage accuracy, detect duplicate or incompatible medications, and ensure consistency with approved clinical guidelines.

Implementing functional control at the prescription stage would reduce the incidence of errors, prevent unnecessary expenditures, and enhance treatment safety for patients (Table 3). Integrating automated validation into the EHIS and the "Pharmaceutical Provision" platform would establish a unified digital environment in which the physician receives alerts regarding potential violations before finalizing the prescription.

Table 3. Key Problem Areas in the Functioning of the Outpatient Pharmaceutical Provision System

Direction	Problem Description	Potential Solution
Procurement Planning	Absence of forecasting models; duplication of requests	Implementation of predictive algorithms based on QALY/DALY metrics and epidemiological data
Logistics	Delivery delays; insufficient storage capacity and cold-chain infrastructure	Establishment of regional reserves and digital supply-chain tracking systems
Financing	Imbalance in budget allocation across nosologies	Clinical and economic reassessment of priorities and dynamic budget planning
Information Systems	Low level of integration between "Pharmaceutical Provision," EHIS, and ERDP	Development of a unified platform for monitoring pharmaceutical flows
Human Resources	High workload on medical personnel	Strengthening workforce capacity and targeted training of specialists

DISCUSSION

The findings of this study demonstrate that the outpatient pharmaceutical provision (OPP) system in the Republic of Kazakhstan is undergoing gradual development; however, it continues to exhibit a number of structural, organizational, and clinical-economic deficiencies that impede the full realization of its potential. Despite a twofold increase in funding between 2014 and 2025 and the expansion of the list of covered nosologies, the current resource allocation model remains imbalanced: a substantial share of expenditures is directed toward high-cost chronic and orphan diseases, while cardiovascular and other prevalent non-communicable diseases remain underfunded. This imbalance highlights the need to adopt more flexible and evidence-based mechanisms for budget planning [11, 12].

A comparative assessment of regional coverage revealed pronounced disparities in access to pharmaceutical therapy. Regions with higher workloads on healthcare facilities demonstrated lower patient coverage combined with significantly higher per-patient spending. This pattern aligns with international observations indicating that insufficient integration of information systems and the absence of demand-forecasting mechanisms contribute to duplication of requests, irrational medicine utilization, and inequities in treatment access. The uneven distribution identified in Kazakhstan is consistent with WHO and OECD findings emphasizing the importance of allocating resources in accordance with epidemiological burden and social priorities [13, 14].

The widespread occurrence of irrational prescribing among patients with diabetes mellitus points to insufficient clinical standardization and the absence of automated prescription-quality control. Similar challenges have been documented in healthcare systems of many countries, where the lack of automated verification algorithms contributes to polypharmacy, excessive spending, and increased risks of adverse therapeutic outcomes. In this context, the introduction of functional and logical control systems represents one of the most effective and evidence-based approaches for reducing prescribing errors and improving the clinical and economic efficiency of OPP [15, 16].

Another significant factor is the insufficient level of digitalization in procurement, logistics, and prescription processes. The fragmentation of information systems ("Pharmaceutical Provision," EHIS, ERDP) reduces the transparency of supply chains and hinders timely detection of shortages. International experience (EU countries, South Korea, Canada) demonstrates that the transition to an integrated digital platform enables accurate demand forecasting, optimization of stock levels, and reduced logistical risks. This challenge becomes particularly critical during epidemiological outbreaks: events of 2020–2024 clearly showed that the absence of predictive modeling systems led to urgent and unplanned procurement of vaccines and anti-infective agents using reserve budget funds [17, 18].

Pharmacoeconomic evaluation of procured medicines also revealed that some pharmaceuticals exhibit questionable cost-per-QALY ratios, indicating the need to revise approaches to formulary development and procurement prioritization. The use of QALY/DALY tools is an internationally accepted standard for rational resource allocation; however, these methods are applied only fragmentarily in Kazakhstan. The indicators obtained in this study confirm the substantial need to integrate clinical-economic criteria into planning, evaluation, and optimization processes for pharmaceutical procurement [19, 20].

Overall, the results of the study highlight the necessity for comprehensive modernization of the OPP system, including the implementation of unified digital platforms, development of analytical and forecasting tools, strengthening of human-resource capacity, and integration of pharmacoeconomic approaches. These directions align with global trends in pharmaceutical policy development and represent key prerequisites for building a sustainable, economically rational, and clinically effective model of outpatient medication provision in the Republic of Kazakhstan.

CONCLUSION

The conducted study demonstrates that the outpatient pharmaceutical provision system in Kazakhstan possesses substantial potential for further development, provided that existing organizational and digital barriers are effectively addressed. The key challenges identified include regional disparities in patient coverage, an inefficient procurement structure, a low level of digital integration, and limited application of pharmacoeconomic tools.

Optimizing the OPP system requires a comprehensive and multifaceted approach, including:

- the transition to a unified digital ecosystem for managing pharmaceutical provision;
- the incorporation of pharmacoeconomic criteria into public procurement processes;
- strengthening the human-resource capacity and ensuring continuous professional training for specialists;
- the application of predictive models based on QALY/DALY metrics and epidemiological indicators.

Implementation of these measures will enhance the transparency, resilience, and economic efficiency of the system, thereby creating the conditions for equitable resource allocation and improved quality of healthcare services for the population.

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