ANNOTATION

for the dissertation work of Maksat Bolatuly Mamyrkul on the topic: «Improvement of Inpatient Care for the Adult Population During a Pandemic: The Case of Multidisciplinary Hospitals in Almaty» submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D10101 - Public Health

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Relevance of the Study.

The COVID-19 pandemic became one of the most significant challenges for healthcare systems worldwide, exposing vulnerabilities in the organisation of inpatient medical care, resource allocation, and workforce sustainability [1]. Under conditions of rapidly increasing demand for hospitalisation, hospitals faced the need for rapid transformation of bed capacity, repurposing of departments, and changes in patient routing [2].

International studies demonstrate that the pandemic was accompanied both by reduced accessibility of planned medical care and by hospital overload, which led to changes in hospitalisation structure and healthcare performance indicators [3]. At the same time, the negative impact on healthcare workers intensified, including increased professional burnout, deterioration of psycho-emotional well-being, and reduced job satisfaction [4].

An additional aspect is the significant economic burden of the pandemic associated with increasing direct medical costs and indirect losses, which has had a long-term impact on the sustainability of healthcare systems [5]. Under these conditions, assessing the preparedness of inpatient care for future epidemiological challenges and developing scientifically grounded approaches for its improvement become especially relevant [6].

Despite the availability of international studies, issues related to the comprehensive analysis of inpatient care transformation during a pandemic at the level of large cities, including organisational, workforce, and economic aspects, remain insufficiently studied. Data reflecting the functioning of inpatient care within specific regional healthcare systems are particularly limited, complicating the development of effective management decisions.

This determines the need for the present study aimed at a comprehensive analysis of the activities of multidisciplinary hospitals and the development of scientifically grounded approaches to improving inpatient medical care during future pandemics.

Purpose of the Study.

To develop scientifically grounded approaches to improving the organisation of inpatient care for the adult population in order to increase healthcare system preparedness for future pandemics based on a comprehensive analysis of multidisciplinary hospitals in Almaty during the COVID-19 pandemic.

Objectives of the Study.

1. To study the theoretical and organisational foundations of inpatient medical care for the adult population during a pandemic.
2. To conduct a comprehensive analysis of the activities of multidisciplinary hospitals in Almaty during the COVID-19 pandemic, including an assessment of the economic burden of hospitalisations.

3. To assess the impact of the pandemic on the professional well-being of healthcare workers and identify factors determining satisfaction with the organisation of inpatient care.

4. To assess the preparedness of the inpatient healthcare system for future pandemics and determine directions for improving its efficiency.

Materials and Methods.

The study used a mixed-methods design and included quantitative and qualitative methods for analysing the activities of multidisciplinary hospitals in Almaty during the COVID-19 pandemic.

A review of scientific literature, international publications, and regulatory documents of the Republic of Kazakhstan was conducted. A retrospective analysis of aggregated statistical data from hospitals for 2017-2025 was performed, including assessment of hospitalisation indicators, bed capacity, mortality, average length of stay, patient routing, and resource provision. Additionally, the economic burden of COVID-19 hospitalisations was evaluated using the cost-of-illness approach.

A cross-sectional survey study was conducted among 1,882 employees of four multidisciplinary hospitals in Almaty to assess professional well-being and satisfaction with the organisation of medical care during the COVID-19 pandemic. Statistical analysis included descriptive statistics, chi-square tests, Mann-Whitney and Kruskal-Wallis tests, logistic regression, and time-series analysis.

The qualitative stage included semi-structured interviews with 16 heads of medical organisations and department managers involved in organising inpatient care during the pandemic. Interview analysis was conducted using thematic analysis. The study was approved by a local bioethics committee, and respondent participation was voluntary with соблюдение principles of confidentiality and informed consent.

Description of the Main Research Results.

The comprehensive analysis of multidisciplinary hospitals in Almaty for 2017-2025 showed that the COVID-19 pandemic was accompanied by a pronounced systemic transformation of inpatient care and had a substantial impact on the volume, structure, and efficiency of the healthcare system. A stable increase in hospitalisations was identified: the average number of hospitalisations increased from 311,036 in the pre-pandemic period to 414,483 in the post-pandemic period (+33.2%), accompanied by a statistically significant upward trend. At the same time, bed capacity expanded by 28.5%. The pandemic led to a marked restructuring of hospital beds: the number of infectious disease beds increased by 243.6%, surgical beds by 68.8%, while therapeutic beds decreased by 38.3%.

The average hospital stay decreased from 8.87 to 8.27 days, indicating improved efficiency in bed utilisation and optimisation of inpatient care. Despite an increase in hospital mortality during the pandemic from 0.93% to 1.43%, the post-pandemic period showed a decrease to 0.8% and restoration of bed occupancy indicators to pre-pandemic

levels. An increased burden on hospitals was identified: the average daily number of patients increased by 33.6%, while bed turnover increased and complication rates decreased by 60.7%. Analysis of patient routing showed changes in hospitalisation structure, including a decrease in admissions through emergency medical services and an increase in referrals from outpatient clinics, reflecting the strengthened role of primary healthcare and a transition toward a more planned hospitalisation model. The results of one-way ANOVA, linear regression, and segmented regression confirmed statistically significant changes in key inpatient care indicators, including bed capacity, average length of stay, bed occupancy, and the proportion of referrals from outpatient clinics. It was established that the COVID-19 pandemic acted not so much as a cause of entirely new processes but rather as a catalyst for already existing trends in healthcare system development, accelerating the structural transformation of inpatient care and the formation of a more adaptive and efficient hospital functioning model.

Results of the Survey Study. The survey of 1,882 healthcare workers in multidisciplinary hospitals in Almaty demonstrated that the COVID-19 pandemic was accompanied by a significant deterioration in indicators of personal and professional well-being among medical staff. Women predominated in the sample (82.9%). More than half of respondents (54.1%) had experience working with patients with confirmed COVID-19, while the greatest involvement was observed among employees of intensive care units (71.3%) and therapeutic departments (68.9%) ($p<0.001$). It was found that 37.9% of healthcare workers had contracted COVID-19, with the highest incidence among intensive care staff (64.1%; $p<0.001$), indicating a high level of occupational risk. A decline in satisfaction with living standards, health status, sleep quality, and mental and physical health was identified in the post-pandemic period. The proportion of respondents with maximum life satisfaction decreased from 45.7% to 39.6%, while the proportion with minimal ratings more than doubled from 11.6% to 23.7% ($p<0.001$). Similar changes were noted regarding health satisfaction: high ratings decreased from 46.4% to 41.3%, while low ratings increased from 11.7% to 22.5% ($p<0.001$).

Deterioration in sleep quality, increased anxiety, and reduced feelings of future security were also identified, reflecting the pronounced psycho-emotional impact of the pandemic on healthcare workers. The most pronounced negative changes were found among employees of anaesthesiology, resuscitation, and intensive care departments, as well as administrative and support units. High professional workload, direct contact with COVID-19 patients, and increased responsibility were associated with worsening professional well-being. The pandemic had a complex negative impact on the physical, psychological, and professional condition of healthcare workers, demonstrating the need for measures to support workforce capacity and strengthen healthcare system resilience in emergencies.

According to the results of qualitative research with the participation of 16 managers multi-profile hospitals of the city of Almaty established that the COVID-19 pandemic revealed systemic unpreparedness of hospital care for emergency epidemiological situations. The main problems were hospital overload, staff shortages, limited bed capacity, and a lack of personal protective equipment and oxygen infrastructure. Modular COVID hospitals have proven to be an effective adaptive strategy, allowing for the expansion of bed capacity, centralization of oxygen supply, and reduction of the burden on multidisciplinary hospitals. It was established that the effectiveness of organizational decisions depended on the timeliness of management measures and coordination between the levels of the healthcare system. Study participants noted high levels of professional burnout and psycho-emotional stress among healthcare workers. Most leaders assessed the healthcare system's readiness for future pandemics as partial due to persistent staffing shortages, limited reserve capacity, and insufficient digital infrastructure. Based on the obtained results, organizational-structural, clinical-flow, resource and management approaches to improving inpatient care in emergency epidemiological situations were developed.

Scientific Novelty.

For the first time, patterns of transformation of the inpatient care system in the context of the COVID-19 pandemic have been established for the city of Almaty. These patterns are characterized by changes in hospitalization rates, bed structure, workload of medical personnel, and patient routing.

For the first time in Almaty, a comprehensive assessment of the economic burden of COVID-19 hospitalizations was conducted using a cost-of-illness approach, including an analysis of direct medical and indirect costs, and the most vulnerable population groups were identified.

For the first time, factors influencing healthcare workers' satisfaction with the organization of inpatient care during the COVID-19 pandemic have been identified.

For the first time, approaches to increasing the resilience of the inpatient care system to future pandemics have been developed based on a comprehensive assessment of the organizational, personnel, and economic aspects of hospital operations.

Main Provisions Submitted for Defence

1. The COVID-19 pandemic led to a systemic transformation of inpatient care in Almaty, characterised by increased hospitalisations, restructuring of bed capacity, changes in patient routing, and increased burden on the healthcare system.

2. The pandemic significantly worsened the professional well-being of healthcare workers and increased occupational risks.

3. Age and gender characteristics of patients significantly influenced the clinical and economic burden of COVID-19 hospitalisations.

4. Approaches to improving inpatient care during pandemics should include optimisation of bed capacity, improvement of patient routing, strengthening workforce and resource provision, and development of digital management tools.

Practical Significance

The obtained results are important for improving the organisation of inpatient care during epidemiological crises and strengthening healthcare system resilience.

The developed approaches may be used by healthcare authorities and medical organisations to optimise bed structure, improve patient routing, distribute resources rationally, and increase hospital efficiency during pandemics.

Data on the economic burden of COVID-19 hospitalizations can be used to plan financial resources, develop emergency financing mechanisms, and evaluate the effectiveness of measures aimed at reducing the burden on the healthcare system.

The obtained results allow us to substantiate the need to implement programs to support healthcare workers aimed at reducing professional burnout, increasing job satisfaction, and strengthening the human resources potential of inpatient services.

The results also justify the need for support programs aimed at reducing professional burnout and strengthening healthcare workforce potential.

Personal contribution of a doctoral student

All the main stages of the research (literature review, collection of materials, their processing, analysis of research materials, interpretation of results, their discussion, formulation of conclusions and recommendations) were carried out personally by the author.

Conclusions

1. Between 2017 and 2025, a systemic transformation of inpatient care took place in Almaty, accompanied by an increase in the number of hospitalizations by 33.2% (from 311,036 to 414,483), an increase in the number of hospital beds by 28.5%, and a decrease in the average length of stay by 6.8% ($\beta = -0.10$; $p = 0.003$). A structural restructuring of hospital beds, an increase in the burden on hospitals, and improved resource efficiency were noted. From 2020 to 2022, the economic burden of COVID-19 hospitalizations peaked in 2021 ($258.0 million), accompanied by an increase in hospitalizations, direct medical costs, and indirect losses, primarily among older patients and men. The COVID-19 pandemic has acted as a catalyst for structural, organizational, and economic changes in the Almaty inpatient care system.

2. During the COVID-19 pandemic, a substantial increase in workload among hospital healthcare workers in Almaty was observed (up to 71.3% in intensive care units), along with a high incidence of COVID-19 among staff (37.9%), reflecting elevated occupational risk under crisis conditions. The pandemic was associated with a statistically significant deterioration in healthcare workers' well-being indicators ($p<0.001$), including reduced life satisfaction (from 45.7% to 39.6%), worsening health status, and poorer sleep quality. Satisfaction with healthcare organization was found to

be associated with the presence of organizational support (OR=1.47–1.91) and adequate resource availability (PPE availability: OR=0.34).

3. Semi-structured interviews showed that the inpatient healthcare system faced critical overload due to increased hospitalisations, workforce shortages, limited bed capacity, oxygen shortages, and insufficient management flexibility.

Testing the results of the dissertation

The main provisions of the dissertation were presented at:

- 10th International Scientific and Practical Conference "Modern Medicine: New Approaches and Current Research," May 2022, Moscow.
- International Symposium "Educational Process: Cooperation, Experience and Science: Kazakhstan-Turkey" (June 20-25, 2023, Istanbul, Turkey).

Publications

Four scientific publications were published on the dissertation topic, including articles indexed in Scopus, SCIE and SSCI (Web of Science), and PubMed.

Akhmetzhan A, Abikulova A, Mamyrkul M, Medeulova A, Nassyrova NB, Faizullina K. Economic Burden of COVID-19 Hospitalization in Almaty, Kazakhstan. Clinicoecon Outcomes Res. 2026;18:569792 https://doi.org/10.2147/CEOR.S569792 (Q2, 74 percentile)

In journals recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Higher Education of the Republic of Kazakhstan (3 articles).

1. Maksat B. Mamyrkul, Akmaral K. Abikulov, Manas E. Ramazanov, Aidos K. Bolatov, Ardak M. Auezova, & Dariga S. Samailova (2022). Organization of the activities of medical organizations in the context of the COVID-19 pandemic. Literature review. Science and Healthcare, 24 (4), 33-43. doi: 10.34689/SH.2022.24.4.005

2. Mamyrkul M., Nazarbayev A., Abikulov A. Lessons from the Covid-19 pandemic: a qualitative study of hospital management and preparedness in Almaty. Actual problems of theoretical and clinical medicine. 2026; (1). https://doi.org/10.64854/2790-1289-2026-51-1-06

3. Maksat Mamyrkul, Adlet Nazarbayev, Kamilla Faizullina, Akmaral Abikulova. Impact of the COVID-19 Pandemic on Inpatient Healthcare Services in Almaty: A Longitudinal Analysis from 2017 to 2025. J Health Dev. 2026, 61 (2), jhd066. https://doi.org/10.32921/2663-1776-2026 61-2-jhd066

Volume and structure of the dissertation

The dissertation consists of 97 pages and includes: an introduction, literature review, materials and methods, research results, conclusion, findings, and practical recommendations. The work contains: 1 figure, 17 tables and 5 appendices. The bibliography includes 168 sources by domestic and foreign authors.