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

Scientific Consultant:
PhD, Associate Professor
Abikulova A.

Foreign Scientific Consultant:
PhD, Professor
Grjibovski A.

Almaty, 2026

Relevance of the Study

The COVID-19 pandemic became one of the most significant challenges for healthcare systems worldwide, exposing their vulnerabilities in the organization of inpatient medical care, resource allocation, and workforce sustainability [1]. Under conditions of a sharp increase in the demand for hospitalization, 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 hospitalization 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 decreased 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 organizational, 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 organization 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 organizational 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 hospitalizations.

3. To assess the impact of the pandemic on the professional well-being of healthcare workers and identify factors determining satisfaction with the organization 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 was conducted using 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 hospitalization indicators, bed capacity, mortality, average length of stay, patient routing, and resource provision. Additionally, the economic burden of COVID-19 hospitalizations 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 organization 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 organizations and department managers involved in organizing inpatient care during the pandemic. Interview analysis was conducted using thematic analysis. The study was approved by a local bioethics committee, and participation was voluntary with adherence to the principles of confidentiality and informed consent.

Description of the Main Research Results

The comprehensive analysis of multidisciplinary hospitals in Almaty for 2017–2025 demonstrated 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 hospitalizations was identified: the average number of hospitalizations 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 also led to a marked restructuring of hospital beds: the number of infectious disease beds increased by 243.6%, and surgical beds by 68.8%, whereas therapeutic beds decreased by 38.3%.

The average length of hospital stay decreased from 8.87 to 8.27 days, indicating improved efficiency in bed utilization and optimization 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%, as well as 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%, accompanied by increased bed turnover and a 60.7% reduction in complication rates.

Analysis of patient routing demonstrated changes in the structure of hospitalizations, 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 model of hospitalization. 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 model of hospital functioning.

According to the results of the survey study involving 1,882 healthcare workers from multidisciplinary hospitals in Almaty, the COVID-19 pandemic was associated with a pronounced deterioration in indicators of personal and professional well-being among medical staff. Women predominated in the sample (82.9%), while more than half of respondents (54.1%) had experience working with patients with confirmed COVID-19. The greatest involvement was observed among employees of intensive care units (71.3%) and therapeutic departments (68.9%) ($p<0.001$).

It was established that 37.9% of healthcare workers had contracted COVID-19, with the highest incidence observed among intensive care personnel (64.1%; $p<0.001$), indicating a high level of occupational risk among clinical staff. 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%, whereas the proportion with minimal ratings more than doubled from 11.6% to 23.7% ($p<0.001$). Similar changes were observed regarding satisfaction with health status: the proportion of 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 medical personnel. The most significant negative changes were observed among employees of anesthesiology, resuscitation, and intensive care departments, as well as administrative and support units. In these groups, statistically significant deterioration in indicators of life satisfaction, health status, sleep quality, and physical and mental health was observed (in all cases $p<0.001$).

High professional workload, direct contact with patients with COVID-19, and increased levels of responsibility were identified as factors associated with worsening professional well-being among healthcare workers. Analysis of professional well-being demonstrated statistically significant changes in satisfaction with working conditions, salary, training opportunities, and additional compensation. At the same time, indicators related to career development, use of professional skills, participation in decision-making, and administrative support demonstrated relative stability.

It was established that the COVID-19 pandemic had a complex negative impact on the physical, psychological, and professional condition of healthcare workers, demonstrating the need to develop measures aimed at supporting workforce capacity and increasing healthcare system resilience to emergency situations.

According to the results of the qualitative study involving 16 managers of multidisciplinary hospitals in Almaty, the COVID-19 pandemic revealed systemic unpreparedness of inpatient care for emergency epidemiological situations. The main problems included hospital overload, staff shortages, limited bed capacity, insufficient personal protective equipment, and inadequate oxygen infrastructure.

It was found that modular COVID hospitals became an effective adaptive strategy that enabled expansion of bed capacity, centralization of oxygen supply, and reduction of the burden on multidisciplinary hospitals. The effectiveness of organizational decisions depended on the timeliness of management measures and coordination between different levels of the healthcare system.

Study participants reported high levels of professional burnout and psycho-emotional stress among healthcare workers. Most managers assessed the healthcare system's preparedness for future pandemics as partial due to persistent staff shortages, limited reserve capacity, and insufficient development of digital infrastructure.

Based on the obtained results, organizational-structural, clinical-flow, resource, and managerial approaches to improving inpatient care in emergency epidemiological situations were developed.

Scientific Novelty

For the first time in Almaty, patterns of transformation of the inpatient care system during the COVID-19 pandemic were identified, characterized by changes in hospitalization indicators, 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 the cost-of-illness approach, including 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 were identified.

For the first time, approaches to increasing the resilience of the inpatient care system to future pandemics were developed based on a comprehensive assessment of the organizational, workforce, and economic aspects of hospital functioning.

Main Provisions Submitted for Defense

1. The COVID-19 pandemic led to a systemic transformation of inpatient care in Almaty, manifested by increased hospitalizations, restructuring of bed capacity, changes in patient routing, and increased burden on the healthcare system, while also acting as a catalyst for organizational changes in inpatient services.

2. The COVID-19 pandemic was accompanied by a significant deterioration in the professional well-being of healthcare workers, increased workload among clinical staff, and a high level of occupational risks, while satisfaction with the organization of inpatient care was determined by resource availability and organizational support.

3. Age and gender characteristics of patients had a significant impact on the formation of the clinical and economic burden of COVID-19 hospitalizations, determining the level of burden on the inpatient healthcare system.

4. Approaches to improving inpatient care during pandemics should include optimization of bed capacity, improvement of patient routing, strengthening of workforce and resource provision, as well as development of digital management tools to increase healthcare system resilience to epidemiological challenges.

Practical Significance of the Study

The obtained results have practical significance for improving the organization of inpatient care during epidemiological crises and increasing healthcare system resilience.

The developed approaches may be used by healthcare authorities and medical organizations to optimize bed structure, improve patient routing, ensure rational distribution of resources, and increase the efficiency of hospital functioning during pandemics.

Data on the economic burden of COVID-19 hospitalizations may be used for planning financial resources, developing emergency financing mechanisms, and evaluating the effectiveness of measures aimed at reducing the burden on the healthcare system.

The obtained results substantiate the need to implement support programs for healthcare workers aimed at reducing professional burnout, increasing job satisfaction, and strengthening the workforce capacity of inpatient services.

The developed approaches may be used in the formation of a sustainable and adaptive inpatient care model capable of functioning effectively during future pandemics and emergency scenarios.

Personal Contribution of the Doctoral Student

All major stages of the study, including literature review, data collection, data processing, analysis of research materials, interpretation and discussion of the results,

and formulation of conclusions and recommendations, were carried out personally by the author.

Conclusions

1. Between 2017 and 2025, a systemic transformation of inpatient care occurred in Almaty, accompanied by a 33.2% increase in hospitalizations (from 311,036 to 414,483), a 28.5% increase in bed capacity, and a 6.8% decrease in average length of stay ($\beta = -0.10$; $p = 0.003$). Structural restructuring of bed capacity, increased hospital workload, and improved resource utilization efficiency were observed. During 2020–2022, the economic burden of COVID-19 hospitalizations peaked in 2021 (USD 258.0 million), accompanied by increased numbers of hospitalizations, direct medical costs, and indirect losses, predominantly among older patients and men. The COVID-19 pandemic acted as a catalyst for structural, organizational, and economic changes in the inpatient care system of Almaty.

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 the organization of care was determined by the presence of organizational support (OR=1.47–1.91) and resource availability (PPE availability: OR=0.34).

3. Semi-structured interviews demonstrated that during the COVID-19 pandemic, the inpatient healthcare system in Almaty faced critical overload associated with increased hospitalizations, staff shortages, limited bed capacity, oxygen shortages, and insufficient management flexibility. Despite improvements in infrastructure and accumulated experience, key vulnerabilities remain, including workforce shortages, limited reserve capacity, insufficient digitalization, and weak integration with primary healthcare.

Testing of Dissertation Results

The main provisions of the dissertation were presented at:

- LX International Scientific and Practical Conference "Modern Medicine: New Approaches and Current Research," May 2022, Moscow, Russia.
- 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. Smailova (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 122 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 197 sources by domestic and foreign authors.

List of References

1. World Health Organization. (2020). Maintaining essential health services: Operational guidance for the COVID-19 context. https://apps.who.int/iris/handle/10665/332240

2. Rezoagli, E., Magliocca, A., Bellani, G., Pesenti, A., & Grasselli, G. (2021). Development of a critical care response: Experiences from Italy during the COVID-19 pandemic. Anesthesiology Clinics, 39(2), 265–284. https://doi.org/10.1016/j.anclin.2021.02.003

3. Moynihan, R., Sanders, S., Michaleff, Z. A., et al. (2021). Impact of COVID-19 pandemic on utilisation of healthcare services: A systematic review. BMJ Open, 11(3), e045343. https://doi.org/10.1136/bmjopen-2020-045343

4. Busis, N. A., Alexander, C. M., Castner, J., et al. (2025). A path to improved health care worker well-being: Lessons from the COVID-19 pandemic. NAM Perspectives. https://doi.org/10.31478/202504a

5. Rajabi, M., Rezaee, M., Omranikhoo, H., et al. (2022). Cost of illness of COVID-19 and its consequences on health and economic system. Inquiry, 59, 469580221144398. https://doi.org/10.1177/00469580221144398

6. World Bank & Institute for Health Metrics and Evaluation. (2016). The cost of air pollution: Strengthening the economic case for action. World Bank.