ANNOTATION

of the dissertation work by Galiya Serikbayevna Bazarbekova entitled «Improvement of Pulmonology Service Delivery to the Population of the Republic of Kazakhstan» submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D10101 – «Public Health»

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Relevance of the Research Topic

Respiratory diseases are among the leading medical, social, and economic challenges in global public health [1]. According to the World Health Organization, chronic respiratory diseases account for more than 4 million deaths worldwide each year, while chronic obstructive pulmonary disease (COPD) is the third leading cause of death globally. Approximately 262 million people worldwide suffer from asthma, and 391 million people live with COPD [2]. Chronic respiratory diseases are considered one of the major causes of disability and reduced quality of life among the working-age population [3].

The epidemiological significance of respiratory diseases in the Republic of Kazakhstan remains consistently high [4]. Among chronic respiratory conditions, bronchial asthma, chronic bronchitis, and COPD occupy the leading positions.

The organization of pulmonology care in the Republic of Kazakhstan is regulated by Order No. 47 of the Minister of Health of the Republic of Kazakhstan (2025) "On Approval of the Standard for the Organization of Pulmonology Care in the Republic of Kazakhstan," as well as by the Code of the Republic of Kazakhstan dated September 18, 2009, "On Public Health and the Healthcare System." In addition, the Healthcare Development Concept of the Republic of Kazakhstan for 2022–2029 identifies the prevention of chronic non-communicable diseases, strengthening of primary healthcare, development of digital healthcare systems, and expansion of access to medical services as key priorities of national health policy.

In contemporary international scientific literature, issues related to the organization of pulmonology care are considered within the framework of integrated care, patient-centered approaches, and risk management principles [5,6]. According to the international GOLD and GINA guidelines, effective control of COPD and bronchial asthma should be based on early diagnosis, regular monitoring, pulmonary rehabilitation, and a multidisciplinary approach. It has been demonstrated that the implementation of pulmonary rehabilitation programs reduces the rate of hospital readmissions by 44%, while significantly improving patients' quality of life as measured by the St. George's Respiratory Questionnaire (SGRQ) [7].

This dissertation research is aimed at a comprehensive assessment of the current state of pulmonology care organization in the Republic of Kazakhstan and relates to the following research areas: implementation of chronic non-communicable disease management programs, evaluation of healthcare quality, development of digital health technologies, assessment of patient satisfaction, and improvement of healthcare accessibility.

The scientific and technical level of the dissertation is based on the principles of evidence-based medicine, the recommendations of GOLD, GINA, ATS/ERS, and contemporary healthcare management methodologies. The study employs medical statistics, systems analysis, sociological research methods, expert evaluation, process mapping, and risk management techniques.

The patent analysis conducted revealed a lack of studies in the Republic of Kazakhstan focusing on comprehensive management models that take into account

regional characteristics of pulmonology care organization, resource constraints, and patient needs.

Therefore, improving the organization of pulmonology care in the Republic of Kazakhstan represents a task of considerable scientific and practical importance aimed at enhancing the quality of healthcare services, reducing complications and mortality associated with chronic respiratory diseases, ensuring the efficient use of healthcare resources, and improving the population's quality of life.

Since the study was conducted in healthcare organizations of Almaty city and Almaty Region, the obtained results reflect regional characteristics of pulmonology care organization. A limitation of the study is the inability to fully extrapolate the findings to the national level.

The purpose of the study: To develop scientifically grounded recommendations based on a comprehensive assessment of the organization of pulmonology care using the example of Almaty city and Almaty Region of the Republic of Kazakhstan.

Research Objectives

1. To conduct an epidemiological study and forecast morbidity and mortality rates of major pulmonary diseases in the Republic of Kazakhstan for the period 2012–2024;
2. To analyze the resource capacity of healthcare organizations providing pulmonology services during 2012–2024;
3. To assess the organization and accessibility of pulmonology care for patients with chronic respiratory diseases (COPD, chronic bronchitis, and bronchial asthma) using the example of Almaty city and Almaty Region;
4. To identify the main challenges and limitations in the provision of healthcare services to patients with respiratory diseases (COPD, chronic bronchitis, and bronchial asthma) using the example of Almaty city and Almaty Region;
5. To develop scientifically substantiated organizational and managerial recommendations for improving the organization of pulmonology care for the population.

Materials and Methods

The study was conducted with the approval of the Local Bioethics Committee of the S.D. Asfendiyarov Kazakh National Medical University (Ethics Review Protocol No. 3(126), dated March 30, 2022).

The object of the study was the pulmonology care system in the Republic of Kazakhstan. The study population included primary healthcare organizations in Almaty city and Almaty Region, hospitals providing pulmonology services, healthcare professionals, and patients with respiratory diseases.

The subject of the study included the accessibility, organization, and resource provision of pulmonology care, continuity of healthcare services, patient satisfaction, and organizational factors affecting the quality of medical care.

The study was conducted in five stages.

Stage 1. A retrospective descriptive and analytical study of morbidity and mortality rates associated with respiratory diseases (COPD, chronic bronchitis, and

bronchial asthma) in the Republic of Kazakhstan during 2012–2024 was carried out. Official statistical data, medical statistical methods, time-series analysis, and comparative epidemiological assessment were used.

Stage 2. A comprehensive assessment of the resource capacity of healthcare organizations providing pulmonology services was conducted. The study focused on the workforce capacity of healthcare organizations delivering care to patients with respiratory diseases and the availability of hospital beds.

The information base consisted of official statistical reports of the Ministry of Health of the Republic of Kazakhstan and statistical compilations entitled "Health of the Population of the Republic of Kazakhstan and Activities of Healthcare Organizations" for the period 2012–2024.

The dynamics of the number of pulmonology specialists from 2012 to 2024 were analyzed, and a forecast of workforce demand up to 2030 was developed. The medium-term forecast was performed using correlation and regression analysis.

Stage 3. A retrospective review of medical records of patients who received outpatient and inpatient treatment in Almaty city and Almaty Region was conducted to assess the organization and accessibility of healthcare services for patients with respiratory diseases.

A total of 1,014 medical records were analyzed, including outpatient records (Form No. 025/e), inpatient records (Form No. 003/e), and discharge summaries (Form No. 027/e) of patients diagnosed with respiratory diseases (COPD, bronchial asthma, and chronic bronchitis).

Stage 4. The study examined the main problems and barriers in the organization of healthcare services from the perspectives of patients receiving pulmonology care in Almaty city and Almaty Region, as well as healthcare professionals providing such care.

A survey was conducted among 477 patients (221 outpatients and 256 inpatients) in Almaty city and Almaty Region. The study assessed patient satisfaction with healthcare services, accessibility of care, and organizational barriers. An author-developed questionnaire adapted from the international PSQ-18 and BCQ questionnaires was used.

In addition, semi-structured interviews were conducted with pulmonologists, general practitioners, and primary healthcare professionals. A total of 48 healthcare workers from Almaty city and Almaty Region participated in the interviews.

Data were statistically processed using Microsoft Excel, SPSS, and Joinpoint Regression Program 4.9.1.0.

Stage 5. The fifth stage of the study was devoted to the development of scientifically substantiated organizational and managerial recommendations aimed at improving the delivery of pulmonology care to the population. These recommendations were formulated on the basis of a comprehensive analysis of the results obtained during the previous stages of the research.

Description of the Main Research Findings

1. The analysis of overall morbidity rates by disease categories registered in healthcare and preventive care organizations during 2012–2024 demonstrated that

the trends were heterogeneous and multifactorial. The absolute number of cases in the general population increased from 4,938,440 cases in 2012 to 5,268,341 cases in 2024, representing a 6.7% increase. However, the morbidity rate per 100,000 population showed a downward trend, decreasing from 29,410.5 in 2012 to 25,327 in 2023, followed by a slight increase to 26,135 in 2024. This indicates a reduction or stabilization of the relative disease burden despite population growth.

An analysis of differences between urban and rural populations revealed persistent inequalities. Throughout the study period, mortality rates in rural areas were consistently higher than those in urban areas. In 2015, the mortality rate was 94.4 per 100,000 population in urban areas and 119.1 per 100,000 population in rural areas. Only in 2020 did mortality among urban residents increase to 125.0 cases per 100,000 population, exceeding the rural rate (119.85) for the first time. This may be attributed to the widespread transmission of infection in large cities and the high degree of urbanization during the pandemic. However, from 2021 onward, mortality among rural residents again remained higher (117.20 versus 103.25 per 100,000 population).

Although overall mortality declined during 2022–2024, mortality rates in rural areas remained consistently higher than those in urban areas in 2024 (75.66 versus 59.78 per 100,000 population). These findings highlight the need to address organizational issues related to healthcare accessibility, early diagnosis, specialized pulmonology care, and preventive interventions in rural settings.

Gender-based analysis demonstrated that mortality from respiratory diseases was higher among men.

Throughout the study period, preventable mortality among men was 2.5–3.0 times higher than among women. For example, in 2011, the mortality rate among men was 2.8 times higher than among women (105.84 and 37.69 per 100,000 population, respectively), while in 2021 the difference remained substantial at 2.4 times (239.93 and 99.30 per 100,000 population, respectively).

Similarly, rates of avoidable mortality among men were 2.7–3.3 times higher than among women. Specifically, in 2011, avoidable mortality among men was 2.8 times higher than among women (70.46 and 25.12 per 100,000 population, respectively), whereas in 2021 this difference increased to nearly threefold (155.05 and 52.01 per 100,000 population, respectively).

Regarding treatable mortality, in 2011 the rate among men was 35.38 (95% CI: 33.67–37.09) compared with 12.57 (95% CI: 11.73–13.41) among women. By 2021, these figures had increased to 84.89 (95% CI: 81.62–88.16) and 47.29 (95% CI: 45.25–49.33), respectively. Thus, while the male-to-female ratio was 2.8 in 2011, it decreased to 1.8 in 2021.

The Average Annual Percent Change (AAPC) increased by 7.5% (95% CI: 3.1–12.2; $p < 0.001$) between 2011 and 2021. The increase was more pronounced among women, with an AAPC of 9.2% (95% CI: 4.8–13.9; $p < 0.001$), compared with men. A particularly significant increase was observed during the period 2015–2021, when the AAPC reached 20.0% (95% CI: 11.6–29.0; $p < 0.001$), compared with 15.0% (95% CI: 4.9–28.1; $p = 0.004$) among men.

According to the forecasting analysis, mortality from respiratory diseases is expected to remain at a high level during 2022–2026. The upward mortality trend is likely to persist, particularly among individuals aged over 45 years.

2. The total number of healthcare professionals in the Republic of Kazakhstan demonstrated a steady increase during the period 2012–2024, rising from 65,512 to 83,379, which represents an increase of 27.3%. Following 2019, a marked increase in the number of pulmonologists was observed, from 157 to 203 specialists, reflecting systemic changes associated with the COVID-19 pandemic.

However, the proportion of pulmonologists within the overall physician workforce remains relatively low. In 2024, pulmonologists accounted for only approximately 0.35% of all physicians, indicating the limited capacity of specialized pulmonology services within the healthcare system.

The shortage of adult pulmonologists amounted to 27.75 full-time equivalent (FTE) positions, of which 25.75 were in urban areas, while only 2.0 FTE positions were reported in rural areas. Pronounced regional disparities in the availability of adult pulmonologists were identified. The highest shortages were recorded in Astana (6.75 FTE positions), North Kazakhstan Region (4.00 FTE positions), and Almaty city (4.75 FTE positions). These findings suggest that pulmonology services are concentrated primarily in urban areas, whereas access to specialized care in rural settings remains extremely limited.

In several regions (Abai Region, Almaty Region, Atyrau Region, and Mangystau Region), a complete absence of pulmonologists (0.00 FTE positions) was identified, indicating either the lack of specialized pulmonology services or their extremely limited availability.

Analysis of actual workforce data for 2019–2024 demonstrated that the demand for pulmonology specialists increased from 145 to 241 positions. Forecasting results suggest that the demand for pulmonologists may reach 309 specialists by 2030, representing an approximately 2.9-fold increase compared with 2019. This trend reflects the growing importance of pulmonology care within the national healthcare system.

To assess the accessibility and adequacy of inpatient treatment services, the dynamics of pulmonology hospital beds were analyzed for the period 2012–2024.

The number of pulmonology beds increased substantially over the study period. In 2012, there were 1,091 pulmonology beds nationwide, whereas by 2024 this number had reached 1,971 beds, representing an increase of 80.7%. The bed availability rate increased from 0.6 to 1.0 per 10,000 population. A particularly sharp increase in bed capacity was observed in 2024.

Bed turnover in adult pulmonology departments increased from 31 in 2012 to 41 in 2024, representing a 32.3% increase. An even greater increase was observed in pediatric pulmonology departments, where bed turnover rose from 35 to 57, corresponding to a 62.9% increase.

The average length of hospital stay decreased from 10.4 to 8.4 days among adults and from 9.3 to 8.4 days among children. These findings indicate increased efficiency of inpatient care, optimization of treatment duration, and improved utilization of hospital bed capacity.

The pulmonology bed capacity in the Republic of Kazakhstan demonstrated substantial growth between 2023 and 2024. The total number of beds increased from 1,396 to 1,971, corresponding to a 41.2% increase, while the bed provision rate rose from 0.7 to 1.0 per 10,000 population.

Regional analysis revealed considerable variation in the expansion of bed capacity. The largest increases were observed in Turkistan Region (from 145 to 277 beds), Zhambyl Region (from 75 to 165 beds), Zhetysu Region (from 60 to 113 beds), and Astana city (from 196 to 250 beds). These increases may be associated with population growth, increased demand for healthcare services, or active development of pulmonology services. In Almaty Region, bed capacity increased markedly from a very low baseline of 9 to 61 beds.

Conversely, some regions experienced a reduction or no change in bed capacity. In Atyrau Region, the number of beds decreased from 42 to 22. Minor reductions were observed in Pavlodar Region (from 57 to 52 beds) and Kyzylorda Region (from 155 to 153 beds). No changes were recorded in Mangystau and Ulytau Regions, which may reflect resource redistribution or reduced demand for inpatient pulmonology services.

3. To assess the organization and accessibility of healthcare services for patients with respiratory diseases, an analysis of medical documentation from healthcare organizations in Almaty city and Almaty Region for the period 2021–2022 was conducted. The majority of patients were residents of urban areas (634 patients; 62.5%), while 380 patients (37.5%) resided in regional and rural areas. Regarding the level of care received, most patients were managed on an outpatient basis (603 patients; 59.5%), whereas 411 patients (40.5%) received inpatient treatment.

A comparison of inpatient pulmonology care provided to urban and regional residents revealed several significant differences. The frequency of consultations with a pulmonologist was significantly higher among urban residents than among regional residents (99.1% vs. 53.0%; $p < 0.001$). Similarly, spirometry was performed considerably more often among urban residents (94.7% vs. 51.4%; $p < 0.001$). Statistically significant differences were also observed in the use of chest radiography (99.1% vs. 90.7%; $p < 0.001$), computed tomography (64.9% vs. 29.0%; $p < 0.001$), and pulse oximetry (79.8% vs. 51.9%; $p < 0.001$).

The assessment of outpatient pulmonology services also revealed substantial disparities in the accessibility and volume of healthcare services between urban and regional populations. Urban residents were more likely to consult a pulmonologist (89.9% vs. 50.3%; $p < 0.001$) and had a greater number of physician visits during the previous 12 months compared with regional residents (4.2 ± 2.0 vs. 2.0 ± 3.6; $p < 0.001$).

Most diagnostic procedures were performed more frequently among urban residents. Statistically significant differences were identified for spirometry (92.4% vs. 60.9%; $p < 0.001$), peak expiratory flow measurement (70.7% vs. 38.1%; $p < 0.001$), chest radiography (96.3% vs. 79.2%; $p < 0.001$), and sputum examination (69.0% vs. 46.7%; $p < 0.001$). No statistically significant differences were observed for computed tomography or pulse oximetry ($p > 0.05$).

4. A total of 477 patients receiving pulmonology care in healthcare organizations of Almaty city and Almaty Region participated in the study evaluating patient satisfaction, accessibility, and organization of healthcare services.

Comparative analysis of outpatient and inpatient groups demonstrated that patients aged ≥60 years were more frequently represented among inpatients than outpatients (41.0% vs. 32.6%; $p = 0.049$). In addition, the proportion of rural residents was significantly higher among hospitalized patients (39.1% vs. 21.3%; $p < 0.001$). Differences were also observed in the diagnostic profile, with COPD and emphysema occurring more frequently among inpatients ($p = 0.011$). Frequent healthcare utilization (>5 visits) was also significantly more common among hospitalized patients ($p = 0.004$).

The mean satisfaction score regarding physicians' professional competence was 4.2 ± 0.5 points, while satisfaction with the clarity of physicians' explanations reached 4.0 ± 0.6 points. These findings indicate a high level of patient trust in healthcare professionals.

At the same time, indicators related to the organization of healthcare services demonstrated lower scores. Accessibility of medical appointments was rated at 3.3 ± 0.7 points, while satisfaction with waiting time was 3.1 ± 0.8 points. These findings suggest the presence of organizational barriers in the delivery of outpatient care.

Overall satisfaction with the quality of healthcare services was 3.9 ± 0.6 points. A total of 62.5% of patients reported being highly satisfied with healthcare services, 27.3% were moderately satisfied, and 10.2% reported low levels of satisfaction.

Comparative analysis between outpatient and inpatient settings demonstrated significantly higher satisfaction among outpatients than among hospitalized patients (3.9 ± 0.5 vs. 3.6 ± 0.7, respectively; $p = 0.02$). This finding may be explained by the continuity of physician–patient interaction and ongoing monitoring at the outpatient level.

Differences were also identified between urban and rural residents. Satisfaction was significantly higher among urban residents (3.9 ± 0.6) compared with rural residents (3.5 ± 0.7; $p < 0.01$), reflecting regional disparities in healthcare accessibility and quality.

Logistic regression analysis demonstrated that patients living in rural areas were significantly more likely to report low satisfaction compared with urban residents (OR = 1.8; 95% CI: 1.2–2.6; $p = 0.004$). This finding may be attributed to lower accessibility and quality of healthcare services in rural areas.

Among patients receiving inpatient treatment, the probability of low satisfaction was significantly higher (OR = 1.6; 95% CI: 1.1–2.3; $p = 0.02$). This may be associated with the complexity of inpatient care organization and the higher proportion of severely ill patients.

To assess healthcare professionals' perspectives on pulmonology services, semi-structured interviews were conducted.

A total of 48 healthcare professionals participated in the survey, including 8 pulmonologists (16.7%), 20 general practitioners (41.7%), and 20 district nurses (41.7%). The average professional experience of participants was 11.3 ± 4.6 years.

Overall, 58.3% of respondents reported insufficient accessibility of diagnostic services. Specifically, limited access to spirometry was reported by 64% of respondents, while 72% identified restrictions in access to advanced diagnostic procedures such as computed tomography (CT). These findings indicate the presence of delays in the diagnostic process. In some healthcare organizations, waiting times for CT examinations may reach 10–14 days, thereby complicating clinical decision-making in urgent cases.

The following factors were identified as the major challenges in the organization of pulmonology services:

– prolonged waiting times (68.8%);

– insufficient diagnostic resources (60.4%);

– workforce shortages (47.9%);

– low levels of patient health literacy (52.1%).

The analysis revealed a statistically significant difference in perceptions of pulmonology care accessibility among different professional groups ($\chi^2 = 4.12$; $p = 0.042$). Reports of poor accessibility were particularly common among nurses (100%).

Only 41.7% of healthcare professionals reported having completed continuing professional education in pulmonology during the previous three years, whereas 58.3% had not participated in any such training.

Analysis of continuing education frequency demonstrated that only 20.8% of respondents received annual training, while 37.5% attended training once every two to three years. These findings indicate insufficient systematization of continuous professional development and may increase the risk of incomplete implementation of contemporary clinical recommendations in routine practice.

5. The comprehensive study identified a number of systemic limitations in the organization of pulmonology services in the Republic of Kazakhstan. Based on these findings, the following evidence-based recommendations were developed to improve pulmonology care for the population.

The proposed model is centered on the establishment of a National Pulmonology Coordination Center. It is recommended to:

* develop standardized diagnostic pathways for respiratory diseases at the primary healthcare level;

* standardize clinical care pathways in accordance with GINA and GOLD recommendations;

* develop comprehensive disease management programs for COPD and bronchial asthma;

* strengthen the role of advanced practice nurses;

* establish regional respiratory centers;

* implement telemedicine and digital patient monitoring systems;

* develop mobile diagnostic units;

* strengthen workforce training and professional development in pulmonology.

The National Pulmonology Coordination Center should provide unified strategic leadership for pulmonology services nationwide. Its key functions should include coordination of regional respiratory centers, monitoring the quality and accessibility of pulmonology care, supervision of clinical protocol implementation, efficient allocation of human and diagnostic resources across regions, and organization of a national epidemiological surveillance system for respiratory diseases.

Conclusions

1. Analysis of trends in overall morbidity indicators for the period 2012–2024 demonstrated a statistically significant decreasing trend ($p < 0.001$). The overall morbidity rate in the population decreased from 29,410.5 to 26,135 per 100,000 population, representing a reduction of 11.1%. In contrast, the overall mortality rate showed an increasing trend during the study period, rising from 57.3 in 2012 to 65.7 in 2024. Mortality among rural residents (75.66 per 100,000 population) remained higher than among urban residents (59.78 per 100,000 population). Joinpoint regression analysis of avoidable mortality rates revealed a statistically significant increase between 2011 and 2021 (Average Annual Percent Change [AAPC] = 7.5%; 95% Confidence Interval [CI]: 3.1–12.2; $p = 0.001$). The increase was more pronounced among women (AAPC = 9.2%; $p < 0.001$), compared with 6.6% among men ($p = 0.024$).

2. Analysis of the workforce capacity of pulmonology services in the Republic of Kazakhstan demonstrated positive trends during 2012–2024. Although the number of pulmonologists increased from 109 to 292 specialists, representing a 2.7-fold increase, their proportion within the overall physician workforce remained low, accounting for only 0.35% in 2024. The shortage of adult pulmonologists amounted to 27.75 full-time equivalent (FTE) positions, while the shortage of pediatric pulmonologists reached 7.25 FTE positions. Forecasting analysis indicated that the demand for pulmonologists may reach 309 specialists by 2030, which is approximately 2.1 times higher than the 2019 level.

The number of pulmonology hospital beds increased from 1,091 to 1,971, representing an increase of 80.7%, while the bed provision rate rose from 0.6 to 1.0 per 10,000 population. In 2024, regional bed availability ranged from 0.2 to 1.8 per 10,000 population, indicating substantial territorial inequalities in access to specialized healthcare services.

3. At the inpatient level, urban residents had significantly greater access to diagnostic services than residents of regional and rural areas. Specifically, 99.1% of urban patients received consultation by a pulmonologist, compared with 53.0% of patients from regional areas ($p < 0.001$). Spirometry was performed in 94.7% of urban patients and 51.4% of regional patients ($p < 0.001$), computed tomography in 64.9% and 29.0%, respectively ($p < 0.001$), and pulse oximetry in 79.8% and 51.9%, respectively ($p < 0.001$).

At the outpatient level, 89.9% of urban residents received pulmonologist consultations, compared with 50.3% of regional residents ($p < 0.001$). Similarly, the proportion of patients enrolled in dispensary follow-up care was 85.0% in urban areas and 66.0% in regional areas ($p < 0.001$), while the proportion attending scheduled follow-up visits was 75.1% and 51.3%, respectively ($p < 0.001$).

4. In Almaty city and Almaty Region, the overall patient satisfaction score regarding the quality of healthcare services for individuals with respiratory diseases was 3.9 ± 0.6 points. A total of 62.5% of patients reported being highly satisfied with the healthcare services received, 27.3% were moderately satisfied, and 10.2% reported low satisfaction. Satisfaction levels were significantly higher among outpatients than among hospitalized patients (3.9 ± 0.5 versus 3.6 ± 0.7, respectively; $p = 0.02$).

The survey of healthcare professionals demonstrated that 62.5% of respondents rated the accessibility of pulmonology services as "moderate" or "low." Furthermore, 70% of general practitioners reported difficulties in timely referral of patients to specialists. A total of 58.3% of healthcare professionals considered access to diagnostic services insufficient. These findings indicate that the main limitations are associated not with individual clinical factors but rather with the complexity of patient pathways, inadequate diagnostic infrastructure, ineffective referral systems, and challenges related to medication supply.

5. A scientifically grounded organizational and managerial model for improving pulmonology services for the population of the Republic of Kazakhstan was developed. The proposed model is aimed at ensuring multilevel integration of pulmonology care and coordinating pulmonology services through a National Pulmonology Coordination Center.

Scientific Novelty

A comprehensive epidemiological and organizational analysis of morbidity, mortality, and healthcare resource indicators related to respiratory diseases in the Republic of Kazakhstan during the period 2012–2024 was conducted.

Using Almaty city and Almaty Region as a case study, a comprehensive assessment of the organization of healthcare services for patients with respiratory diseases was performed, including an evaluation of patients' and healthcare professionals' perceptions regarding the accessibility and organization of pulmonology care.

A scientifically grounded organizational and managerial model for improving pulmonology care in the Republic of Kazakhstan was developed.

Practical Significance

The findings of the study provided a comprehensive assessment of the current state of the pulmonology care system in the Republic of Kazakhstan and identified its key organizational challenges.

The results obtained may serve as a practical evidence base for informed managerial decision-making aimed at improving pulmonology services. Furthermore, the proposed recommendations may be utilized in healthcare

planning, resource allocation, workforce development, and the enhancement of accessibility and quality of pulmonology care at both regional and national levels.

Key Provisions Submitted for Defense

1. The persistently high incidence rates of respiratory diseases, including pneumonia, chronic bronchitis, and bronchial asthma, in the Republic of Kazakhstan during 2012–2024, as well as the observed upward trends in selected disease categories, substantiate the need for further improvement of the organization of pulmonology care.

2. Analysis of the human resources, diagnostic capacity, and material and technical resources of pulmonology services revealed uneven distribution of healthcare resources across regions. Despite an increase in the number of pulmonologists and specialized hospital beds, workforce shortages and interregional disparities continue to exist.

3. Patient satisfaction with healthcare services among individuals with chronic respiratory diseases is significantly influenced by healthcare accessibility, timeliness of diagnostic investigations, availability of medications, quality of physician–patient interaction, and effectiveness of follow-up monitoring within the healthcare system.

4. According to healthcare professionals providing pulmonology care, the major organizational factors reducing the effectiveness of pulmonology services include workforce shortages, limited diagnostic capacity, insufficient coordination of patient care pathways, and challenges in the implementation of clinical protocols.

Personal Contribution of the Doctoral Candidate

The personal contribution of the doctoral candidate consisted of direct participation in all stages of the research process, including the development of the theoretical and methodological framework of the study, adaptation of international questionnaires, formulation of the research aim and objectives, organization and implementation of the study, statistical data analysis, preparation of dissertation chapters, conduct of the sociological survey, interpretation and discussion of the findings, formulation of the key provisions submitted for defense, as well as the development of conclusions and practical recommendations.

Approbation of the Study

The main findings of the dissertation research were presented and discussed at international scientific and practical conferences and forums:

- Kudarova A.S., Bazarbekova G.S., Kumar A.B. Application of a Mobile Health Application in Patients with Chronic Obstructive Pulmonary Disease. International Scientific and Practical Conference “Environmental Sustainability and Population Health” for Young Scientists and Students, Kyrgyz Republic, April 8–9, 2022.

- Bazarbekova G.S., Kumar A.B. The Role of Artificial Intelligence and Machine Learning in Pulmonology and the Diagnosis of Chronic Respiratory

Diseases. Proceedings of the 2nd International Forum “Asfen.Forum: New Generation – 2024”. Almaty: KazNMU, 2024. pp. 269–270.

Publications

A total of four scientific publications related to the dissertation topic have been published, including:

I. Publications in journals indexed in the Scopus database (1 article):

- Bazarbekova G., Inkarbekov M., Qumar A.B., Kosherbayeva L., Akhmetzhan A., Suieubekov B. Mortality Trends from Respiratory Disease in Kazakhstan: A 2011–2021 Analysis. Journal of Public Health Research. 2025;14. DOI: 10.1177/22799036251341526.

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

- Serikbayev M.A., Bazarbekova G.S., Mamyrbekova S.A., Kudarova A.S., Kumar A.B., Kusainov A.Z. Practice-Oriented Approach to Nursing Education in Pulmonology Services. Pharmacy of Kazakhstan. No. 2 (241), April 2022.

- Bazarbekova G.S., Aman B.Zh., Kumar A.B. Organization of Pulmonology Services in Kazakhstan: Challenges and Future Prospects. Science and Healthcare. 2022;24(3):30–35. DOI: 10.34689/SH.2022.24.3.004.

- Bazarbekova G.S., Inkarbekov M.Zh., Kudarova A.S., Kumar A.B., Seiduanova L.B. Nursing Strategies for the Prevention and Management of Chronic Obstructive Pulmonary Disease. Pharmacy of Kazakhstan. No. 3 (248), June 2023.

Volume and Structure of the Dissertation

The dissertation consists of an introduction, five chapters, a conclusion, conclusions, practical recommendations, and a bibliography comprising 170 references.

The dissertation is presented in 123 pages of typed text and includes 29 tables, 8 figures, and 3 appendices.

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