

ABSTRACT
of the dissertation based on a series of publications
by OLZHAS ZHAMANTAYEV
on the topic: " The influence of socioeconomic factors on the medico-demographic
indicators of the population of the Republic of Kazakhstan"
for the degree of Doctor of Philosophy (PhD) in the specialty 6D110200 – Public
Health

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Relevance

The Republic of Kazakhstan pursues a consistent policy aimed at strengthening public health and achieving the UN Sustainable Development Goals, with special attention to reducing medico-social risks, improving demographic indicators through managed interventions, and mitigating regional inequalities. The Concept for the Development of Healthcare until 2026 (Government Decree of the Republic of Kazakhstan No. 945 of November 24, 2022) sets targets to reduce maternal mortality (MMR) to 9.9 per 100,000 live births and infant mortality (IMR) to 7.1 per 1,000 live births, to increase life expectancy to 75.1 years, and to reduce premature mortality from non-communicable diseases (NCDs) by 19.3%. These objectives are supported by the Concept for the Development of Healthcare Infrastructure for 2024–2030 (Government Decree No. 454 of May 30, 2024), which provides for modernization of medical institutions, reduction of facility wear-and-tear to 30%, and achievement of adequate staffing levels, particularly important for ensuring service accessibility among vulnerable groups. The ongoing reforms align with national priorities for digital transformation and social stability, as outlined in the President's Address to the Nation (September 8, 2025). Kazakhstan, a middle-income country according to the World Bank classification, has seen declining infant and maternal mortality rates, but regional disparities remain pronounced (Abenova et al., 2021; Sabyrdilda et al., 2024).

For public health experts, medico-demographic indicators such as infant and maternal mortality and the burden of chronic diseases reflect socioeconomic conditions and the efficiency of the health system at the national or regional level. A number of studies have shown that infant mortality is closely associated with socioeconomic determinants of health in low- and middle-income countries (Kim, 2013; Gonzalez, 2017). Amid the epidemiological transition, the contribution of NCDs is increasing, with socioeconomic determinants and health system resources influencing the variability of morbidity and mortality (Ndubuisi, 2021). For child health, both access to healthcare and broader social and environmental conditions play prominent roles (Goodarzi et al., 2022). Overall, the Central Asian region faces common challenges like low share of GDP devoted to health (2.5–4%), limited

access to healthcare in rural areas, and relatively high income inequality (Weaver et al., 2021; World Bank International Development, 2022).

Research aim

To assess the influence of socioeconomic and healthcare resource factors on the key medico-demographic health indicators of the population of the Republic of Kazakhstan from 2000 to 2020 and to develop evidence-based recommendations..

Research objectives

1. To study the trends and regional disparities in infant mortality and assess their relationship with socioeconomic and medico-demographic factors.

2. To analyze the trends and associations of maternal mortality with socioeconomic and medico-demographic factors.

3. To evaluate the trends and effects of socioeconomic and organizational factors on child morbidity by major disease categories.

4. To develop recommendations for health authorities and related sectors on the analysis of infant and maternal mortality and child morbidity, taking into account regional differences in resources and risks.

Materials and methods

Study design:

The entire series of publications represents a retrospective panel study based on aggregated regional data of the Republic of Kazakhstan. Analytical units included 14 regions and 3 cities of republican significance observed over extended periods (core panel analyses – 2010–2019; for IMR and MMR – 2000–2020).

Data sources:

Official annual statistical collections and reports from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan and the Ministry of Health, including:

- Demographic Yearbook of Kazakhstan
- Environmental Protection in the Republic of Kazakhstan
- Living Standards of the Population of Kazakhstan
- Health of the Population and Activities of Healthcare Organizations
- Women and Men in Kazakhstan
- Regions of Kazakhstan
- Statistical tables on Financial and Economic Activities of Healthcare Organizations and Household Expenditures and Income.

Additional data were obtained from UNICEF, the World Bank, and WHO open databases.

Statistical analysis:

Time series and summary tables were constructed by region and year to describe variables and identify temporal trends. To standardize indicators, normalize distributions, and stabilize variance, natural logarithmic transformations (ln) were applied. Preliminary associations were tested using Pearson or Spearman

correlations. Multicollinearity was controlled via Variance Inflation Factor (VIF). For IMR and MMR, multiple linear regression with stepwise selection (backward/bidirectional) was applied, reporting unstandardized and standardized coefficients, 95% CIs, p-values, and adjusted R². For regional morbidity among children aged 0–14, panel/mixed models (LMM/FE/RE) were used, accounting for temporal and regional heterogeneity, selecting effect structures by AIC/BIC criteria, and testing residual autocorrelation. Analysis was conducted in IBM SPSS Statistics 26.0 and R-Studio 1.2.5033, with checks for heteroskedasticity and residual autocorrelation.

Scientific novelty

For the first time in Kazakhstan, quantitative elasticity estimates (log-log models) of indicators were obtained, determining how 1% changes in socioeconomic or resource indicators are associated with percentage changes in infant mortality and child disease rates.

Newly identified associations for Kazakhstan were established between IMR, MMR, and child morbidity and specific socioeconomic and organizational factors.

Integration of living wage, housing provision, and income inequality indicators into analytical monitoring panels for healthcare is proposed.

The study theoretically and empirically substantiates the interconnection between medico-demographic indicators of different age groups (infants – children – mothers) and the same socioeconomic parameters (poverty, inequality, employment, housing).

Main statements submitted for defense

IMR in Kazakhstan is statistically significantly associated with a set of socioeconomic indicators.

MMR is affected by external shocks. Key socio-medical factors include educational coverage, antenatal care coverage, and levels of domestic violence.

Income inequality is positively associated with morbidity from respiratory, nervous system diseases, and asthma among children; unemployment is positively related to nervous system diseases.

Measures to reduce poverty and unemployment, prevent domestic violence, expand antenatal care coverage, strengthen primary healthcare, and improve housing conditions contribute to lowering IMR, MMR, and the burden of child morbidity.

Theoretical significance

The series of four articles consistently demonstrates that socioeconomic factors (income inequality, poverty, unemployment, housing provision) and health system characteristics (availability and capacity of primary care, staffing levels, antenatal care coverage) are statistically associated with key medico-demographic indicators – IMR, MMR, and child morbidity. This confirms and clarifies the theoretical concept of Social Determinants of Health within the Kazakhstani context.

The study relies on official national and regional statistical data and applies comparable econometric and biostatistical approaches (panel/regional regression

analysis, multivariable models controlling for confounding), forming a reproducible analytical framework for future public health research in Kazakhstan.

The empirical findings support state program priorities and the Healthcare Development Concept until 2026, providing quantitative justification for budget planning and investment efficiency assessment in maternal and child health. The results may be used by executive authorities to substantiate socio-economic measures targeting vulnerable population groups.

Practical significance

The findings of the dissertation research have been implemented in the activities of Karaganda Medical University and Astana Medical University to strengthen scientific and educational capacity in the field of public health. Implementation includes the integration of methodological approaches and evidence-based conclusions into academic disciplines, case-based exercises, and analytical reports, as well as developing staff and student competencies in official statistics and panel data analysis.

The results have also been introduced into the analytical, methodological, and educational work of the Karaganda Branch of the Salidat Kairbekova National Scientific Center for Health Development, enhancing health indicator monitoring and supporting management decisions in the regional health system.

Volume and structure of the dissertation

The materials are presented in four peer-reviewed publications indexed in Clarivate Analytics (Web of Science), belonging to Q1–Q2 quartiles:

1. Yerdessov N., Zhamantayev O., Bolatova Z., Nukeshtayeva K., Kayupova G., Turmukhambetova A. *Infant Mortality Trends and Determinants in Kazakhstan. Children.* 2023; 10(6): 923. (Q2, Corresponding Author)
2. Nukeshtayeva K., Kayupova G., Yerdessov N., Bolatova Z., Zhamantayev O., Turmukhambetova A. *Factors Associated with Maternal Mortality in Kazakhstan: A Pre- and During-Pandemic Comparison. Frontiers in Public Health.* 2024; 12: 1337564. (Q1, Co-author)
3. Smagulov N., Zhamantayev O., Aitkulov A., Yerdessov N., Nukeshtayeva K., Bolatova Z., Kurzhunbaeva Z. *Pre-COVID Era Pediatric Disease Incidence in Kazakhstan: Regional Panel Data Analysis of Multiple Disease Groups (2010–2019). Frontiers in Public Health.* 2025; 13: 1615521. (Q1, Corresponding Author)
4. Zhamantayev O., Smagulov N., Tykezhanova G., Konkabayeva A., Nukeshtayeva K., Zhanalina G., Aldanova Z., Shintayeva N., Kurzhunbaeva Z. *Relationships between Infant Mortality and Socioeconomic and Demographic Factors in Kazakhstan: An Analysis from a Middle-Income Country in Central Asia. BMC Public Health.* 2025; 25(1): 2350. (Q1, First Author)

Approbation

The results were presented at the 7th World Congress on Public Health (WCPH), Rome, Italy, May 2–6, 2023.

Publications

A total of eight scientific papers were published, including seven original articles in peer-reviewed international journals indexed in Clarivate Analytics and/or Scopus, and one conference abstract. Two copyright certificates and two methodological recommendations (approved for publication by the Salidat Kairbekova National Scientific Center for Health Development) were obtained.

Conclusions

1. Infant mortality in Kazakhstan decreased by an average of 1.49 points per year ($\beta = 1.49$; $p < 0.001$) between 2000–2020, with persistent regional disparities (higher rates 11–13 ‰ in the southwestern regions). A 1% increase in unemployment was associated with a 0.357% increase in IMR ($p < 0.001$); a 1% increase in the share of population below the living wage – with a 0.164% rise; a 1% increase in living wage – with a 0.472% decline; a 1% increase in housing provision – with a 0.563% decline.

2. Maternal mortality declined by an average of 2.13 points per year ($p < 0.001$) from 2000–2019. Lower MMR levels were associated with early and full antenatal care coverage ($\beta = -2.513$; $p = 0.003$) and availability of nursing and midwifery staff ($\beta = -0.891$), while higher MMR was linked to divorce rates ($\beta = 14.96$) and domestic violence against women ($\beta = 1.53$). MMR correlated negatively with total health expenditures ($r = -0.86$; $p < 0.01$).

3. Among children aged 0–14, respiratory and nervous system disease incidence declined annually by 42.5 and 8.3 points, respectively, from 2010–2019. Respiratory diseases were negatively associated with population density and positively with unemployment; nervous system diseases were positively associated with unemployment levels.

4. Based on the study results, recommendations were developed for integrating living wage, housing provision, and income inequality indicators into health monitoring systems and for academic use in training public health professionals in data analysis and policy evaluation.

Recommendations

To identify the reduction of unemployment and poverty, targeted improvement of housing conditions, and support for decent family incomes as priority measures to reduce IMR and MMR across regions.

Legislative and executive authorities should index the living wage to inflation and regional disparities based on the study's findings.

To develop an integral “Risk Index” combining current levels of infant and maternal mortality, child morbidity, antenatal care coverage, and the “social gradient” (unemployment, poverty, Gini coefficient, housing per capita, average income). This index can be integrated into analytical health monitoring dashboards for automatic calculation and regional risk ranking by quartiles.

To apply the developed approaches in training public health specialists at medical universities, organizing project schools and internships under the National Scientific Center for Health Development, and launching data-analytics training laboratories.

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