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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE IMPACT OF BIRTH WEIGHT ON INFANT MORTALITY IN KAZAKHSTAN

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Abstract.

Introduction: Recognizing the importance of birth weight is fundamental to addressing public health challenges associated with maternal and child health. Birth weight serves as a critical indicator, offering insights into mortality, stunting, and the development of chronic diseases later in life. This study delves into fertility and infant mortality trends in Kazakhstan, with a specific focus on understanding urban-rural disparities and gender variations in mortality rates.

Objectives: The primary objective of this study is to evaluate the influence of birth weight on infant mortality in Kazakhstan, considering demographic and regional nuances. Through comprehensive analysis, we aim to discern patterns and factors contributing to infant mortality, thereby informing targeted interventions and policies aimed at improving maternal and child health outcomes across the country.

Materials and Methods: The analysis was conducted using the data provided by the Republican State Enterprise on the PCV of the "Republican Centre for Electronic Health Care" of the Ministry of Health of Kazakhstan.

Results: In Kazakhstan, birth rates reached their zenith in 2021 (total 446,491 births). However, this figure experienced a downturn in 2022, declining to 403,893 births. Notably, urban regions consistently reported higher birth rates compared to rural areas. The year 2022 witnessed a decline in birth rates across both urban and rural populations, with decreases of 9.5% and 11.7%, respectively, compared to the previous year. Analysis using linear regression techniques on infant mortality rates spanning from 2017 to 2022 revealed no statistically significant time trend (slope = 51.29, correlation coefficient = 0.42, p = 0.41). Gender-specific disparities in mortality rates were starkly evident, with boys exhibiting higher mortality rates compared to girls across all population subsets. Geographical analysis conducted in 2022 exposed significant divergences in mortality rates across various regions.

Conclusions: The study highlights significant urban-rural disparities and gender differences in birth rates and infant mortality within Kazakhstan. It also confirms the protective effect of higher birth weight on infant mortality. Regional disparities suggest targeted public health interventions are necessary to address these variations effectively.

Key words. Epidemiological monitoring, infant mortality, birth weight, Kazakhstan.

Introduction.

Birth weight is a crucial indicator of both maternal and foetal health, serving as a predictor for various health outcomes throughout life. It is a fundamental measure that reflects the intrauterine environment, maternal nutrition, and overall prenatal care [1,2]. The weight of a newborn at birth is influenced by numerous factors, including genetic predisposition, maternal health status, environmental exposures, and socioeconomic factors [3,4]. Understanding the significance of birth weight is essential in addressing public health concerns related to maternal and child health, as it plays a pivotal role in predicting mortality, stunting, and chronic diseases later in life [5].

Birth weight serves as an essential indicator of maternal and foetal health during pregnancy [5,6]. Low birth weight (LBW), defined as less than 2,500 grams (5.5 pounds) at term, is associated with a higher risk of infant mortality and morbidity [7,8]. LBW infants are more susceptible to infections, respiratory distress syndrome, and neurological complications [9,10]. Additionally, LBW is often a consequence of maternal malnutrition, inadequate prenatal care, maternal smoking, and pregnancy complications such as preeclampsia and gestational diabetes [11-13]. On the other hand, high birth weight (macrosomia), typically defined as greater than 4,000 grams (8.8 pounds), can increase the risk of birth injuries, caesarean deliveries, and maternal complications such as postpartum haemorrhage [14,15].

Birth weight is a strong predictor of infant mortality and childhood stunting. Infants born with LBW are at a significantly higher risk of mortality within the first year of life compared to infants with normal birth weight. LBW is often associated with preterm birth and intrauterine growth restriction (IUGR), both of which increase the likelihood of neonatal complications and mortality [16,17]. Furthermore, LBW infants who survive infancy are more likely to experience stunted growth and developmental delays during childhood [18-20]. Stunting, characterized by impaired linear growth, is associated with long-term health consequences, including cognitive impairment, reduced educational attainment, and increased risk of chronic diseases in adulthood.

Birth weight has implications beyond infancy and childhood, extending into adulthood and influencing the risk of chronic diseases later in life. The Developmental Origins of Health and Disease (DOHaD) hypothesis proposes that adverse intrauterine conditions, reflected by LBW or macrosomia, can "program" the foetus for increased susceptibility to chronic diseases in adulthood [21-23]. Epidemiological studies have demonstrated associations between LBW and an increased risk of cardiovascular disease, type 2 diabetes, hypertension, and metabolic syndrome in adulthood [24-26]. Conversely, macrosomia has been linked to an elevated risk of obesity, insulin resistance, and cardiovascular complications in later life [26-29]. These findings underscore the importance of early life interventions and preventive measures to mitigate the long-term health consequences associated with aberrant birth weight.

Addressing the determinants of birth weight, such as improving maternal nutrition, enhancing access to prenatal care, and reducing environmental exposures, is essential for promoting optimal maternal and child health outcomes. Moreover, early life interventions aimed at mitigating the long-term health consequences of aberrant birth weight are imperative for reducing the burden of chronic diseases in adulthood.

The global infant mortality rate was estimated to be 35 deaths per 1,000 live births, with the highest rate in Africa (about 44 per 1,000 live births) [30,31], and the lowest in Japan [32-34], and the Scandinavian countries (2.1–2.4 per 1,000 live births) [35,36]. Differences among populations reflect economic and social conditions that influence maternal and newborn health and the effectiveness of the health care system.

In Kazakhstan, like many other countries, addressing infant mortality (IMR) is a significant public health priority. IMR reflects the number of deaths of infants under one year of age per 1,000 live births and serves as a measure of the effectiveness of healthcare services, access to maternal and child health care, socio-economic development, and overall living conditions. Understanding the factors contributing to infant mortality in Kazakhstan is essential for devising targeted interventions and policies to improve maternal and child health outcomes. According to the latest available data from the World Bank, the infant mortality rate in Kazakhstan was 9.5 deaths per 1,000 live births in 2020 [37-39]. Several factors contribute to infant mortality in Kazakhstan. It includes the disparities in access to healthcare services, particularly in rural and remote areas, can impact infant mortality rates. Limited access to prenatal care, skilled birth attendants, and neonatal intensive care units (NICUs) can increase the risk of adverse outcomes for both mothers and infants.

In this study, we examined trends in birth weight-adjusted and birth weight-adjusted IMR rates in the Republic of Kazakhstan.

Materials and Methods.

Ethical Considerations:

The ethical approval for this study was granted by the Local Ethics Committee of the S.D. Asfendiyarov Kazakh National Medical University, Almaty, Republic of Kazakhstan under protocol number 12 (119) dated September 28, 2023.

Data Sources:

This retrospective cohort study utilized data sourced from the Republican State Enterprise on the REC of the "Republican Centre for Electronic Health Care" of the Ministry of Health of the Republic of Kazakhstan. The data encompassed the period from 2017 to 2022, specifically targeting newborn medical records. These records included essential demographic details of live-born infants such as birth location, birth date, and birth weight categorized into four groups (<500 g, 500-999 g, 1000-1499 g, 1500-2499 g, 2500 g or more). Additionally, official statistics on infant mortality rates segmented by gender (male and female) and population type (urban and rural) were analyzed to ascertain the number of infants who died before reaching one year of age, presented per 1,000 live births.

Data Analysis:

The data were stratified by birth weight into five categories: <1500 g, 1500-1999 g, 2000-2499 g, <2500 g (low birth weight, LBW), and ≥2500 g. Birth weight prevalence per 100 live births was calculated for these categories along with 95% confidence intervals (CIs). Analysis was performed on all live births, regardless of the availability of birth weight data, and subsequently focused on those with recorded birth weight. Detailed analysis included prevalence and mean birth weight across different demographics such as maternal age, maternal education level, wealth index, sex of the child, duration of pregnancy, and place of birth, along with survival status.

Multiple logistic regression analysis was employed to explore the association between low birth weight and various factors in live births where birth weight data was available. Odds ratios (ORs) with 95% confidence intervals were reported. Comparisons of infant mortality between genders and between urban and rural populations were conducted using independent samples t-tests. Linear regression was utilized to assess the trend in overall infant mortality rates in Kazakhstan from 2017 to 2022.

Additionally, the study explored the relationships between neonatal (0-27 days) and post-neonatal (28 days to 1 year) mortality rates and birth weight. Differences in neonatal mortality rates between infants with known and unknown birth weights were used to adjust the prevalence of LBW proportionally, thus estimating the prevalence of LBW among infants whose birth weight was not recorded.

In our study, the distinction between urban and rural regions was based on administrative division criteria. Urban regions were defined as settlements with official city status, such as Almaty, Astana (previously Nur-Sultan), Shymkent, and other major cities. Rural regions were defined as settlements without city status, including villages, hamlets, and townships.

Statistical analysis:

All statistical analyses were performed using SPSS software (version 22). Independent t-tests were used to assess differences in infant mortality rates between different groups. Linear regression was used to evaluate changes in infant mortality rates over time (from 2017 to 2022). A p-value of ≤ 0.05 was considered statically significant.

Results.

A study of fertility dynamics between 2017 and 2022 (Table 1) found that the total number of births increased from 390,262 to a peak of 446,491 in 2021, followed by a decline to 403,893 in 2022. Throughout the observation period, urban birth rates dominated over rural ones, with the maximum number of births in cities being recorded in 2021 (262,507), and in rural areas in 2020 (177,197).

The reduction in the number of births in 2022 was 9.5% for the urban population and 11.7% for the rural population compared to the previous year.

Analysis of the time trend (Table 2) in overall infant mortality using linear regression showed that the trend slope is 51.29, with a correlation coefficient of 0.42 (p=0.41), which does not allow us to consider the observed change statistically significant. The highest infant mortality rate was observed in 2021 (8.41 per 1,000 live births), while the lowest was in 2017 (7.93 per 1,000 live births). The t-test results showed significant differences in mortality between boys and girls: for the general population

Table 1. *Dynamics of the birth rate of the Republic of Kazakhstan in the period from 2017 to 2022.*

Index	Birth rate					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Born alive: Total	390 262	397 799	402 310	426 824	446 491	403 893
Including						
Urban population	226 847	235 014	239 496	249 627	262 507	241 459
Rural population	163 415	162 785	162 814	177 197	183 984	162 434

Table 2. *Association of infant mortality and gender of the Republic of Kazakhstan.*

Years	Infant mortality						*p*
	Number of deaths of children under 1 year of age			Deaths under 1 year of age. per 1.000 live births			
	boys	**girls**	**total**	**boys**	**girls**	**total**	
All population							≤0.05
2017	1 771	1 338	3109	7.93	8.74	7.06	
2018	1 892	1 292	3 184	8.03	9.25	6.74	
2019	1 944	1 416	3 360	8.37	9.37	7.3	
2020	1 888	1 398	3 286	7.77	8.63	6.85	
2021	2 062	1 670	3 732	8.41	9.01	7.78	
2022	1 764	1 354	3 118	7.68	8.52	6.8	
Urban population							≤0.05
2017	935	765	1 700	7.48	7.96	6.96	
2018	1 111	735	1 846	7.9	9.2	6.51	
2019	1 176	881	2 057	8.61	9.52	7.64	
2020	1 211	883	2 094	8.43	9.41	7.38	
2021	1 489	1 234	2 723	10.45	11.07	9.78	
2022	1 001	759	1 760	7.2	7.94	6.4	
Rural population							≤0.05
2017	836	573	1 409	8.55	9.81	7.19	
2018	781	557	1 338	8.21	9.31	7.05	
2019	768	535	1 303	5.38	9.14	6.79	
2020	677	515	1 192	6.84	7.52	6.11	
2021	573	436	1 009	5.52	6.08	4.92	
2022	799	595	1 394	8.41	9.36	7.39	

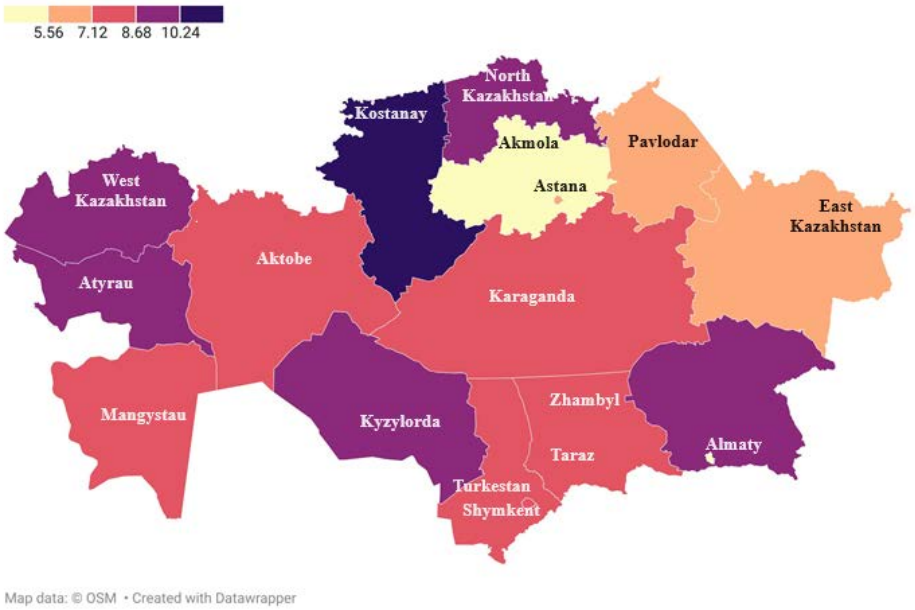

Figure 1. *Mortality rate per 1000 live births of the Republic of Kazakhstan in the 2022.*

Table 3. *Subgroups in context of mortality rate of the Republic of Kazakhstan in the 2022.*

Regions	**Mortality rate per 1000 live births**				
	500-999	**1000-1499**	**1500-2499**	**2500 and more**	**Total**
Almaty city	644.4	303.3	58.9	3.9	**10.1**
Astana city	528.3	82.8	22.6	2.1	**6.2**
Shymkent city	632.2	216.7	29.3	3.1	**7.3**
Akmola region	666.7	69.0	15.1	1.9	**4.0**
Aktobe region	695.7	288.7	36.3	3.5	**8.5**
Almaty region	271.4	80.1	17.8	2.3	**5.4**
Atyrau region	704.2	295.1	48.5	3.8	**9.4**
East Kazakhstan region	484.5	127.8	25.5	2.4	**6.6**
Zhambyl region	446.6	195.8	31.3	3.2	**7.5**
West Kazakhstan region	607.8	315.8	27.3	3.8	**9.0**
Karaganda region	534.1	267.2	30.8	3.4	**8.3**
Kostanay region	650.0	250.0	65.4	5.5	**11.8**
Kyzylorda region	702.7	204.3	47.5	4.5	**9.7**
Mangistau region	644.7	158.4	31.4	4.4	**8.3**
Pavlodar region	584.9	101.7	35.8	2.2	**7.0**
North kazakhstan region	617.6	111.1	39.8	3.8	**10.0**
Turkestan region	613.6	166.1	39.6	4.5	**8.4**
Total					
Mean ± SD	589.9±110.6	190.2±85.7	35.4±13.5	3.4±1.0	8.0±1.9

(t=6.67, p≤0.000), for the urban population (t=2.52, p=0.03), and for the rural population (t=4.44, p=0.0013). The comparison of mortality between urban and rural populations also showed statistically significant differences (t=4.59, p≈0.001).

The map illustrates (Figure 1) the distribution of mortality rates per 1,000 live births across various regions of Kazakhstan, categorized into four mortality rate intervals: 500-999, 1000-1499, 1500-2499, and 2500 and more.

Key data points include high mortality rate regions such as Atyrau and Kyzylorda, which report numbers in the higher intervals, contrasting with areas like Almaty region that show lower figures.

In examining the mortality rate per 1000 live births across various regions of the Republic of Kazakhstan in 2022 (Table 3), we observe a heterogeneous distribution reflecting different population health outcomes.

The mortality rates in the most populated cities (Almaty, Astana, and Shymkent) show varied figures, with Almaty City demonstrating a higher rate in the lowest category (644.4) compared to Astana City and Shymkent City, which displayed 528.3 and 632.2, respectively.

Across the broader regions, we noted that Atyrau and Kyzylorda regions had some of the highest entries in the 1000-1499 category with rates of 295.1 and 204.3, respectively, indicating specific regional challenges. Conversely, the East Kazakhstan and Almaty regions reported comparatively lower mortality rates in the same category at 127.8 and 80.1.

When aggregating the data, the average mortality rate per 1000 live births across all regions and categories stands at (589.9 ± 110.6), highlighting considerable variability.

In the linear regression model assessment (R = 0.845), the coefficient for birth weight is -0.1913, indicating that for every gram increase in birth weight, infant mortality decreases by 0.1913 per 1,000 live births (p = 0.043).

Discussion.

Urbanization is a global phenomenon reshaping the demographic landscape of countries worldwide, and Kazakhstan is no exception. Over recent decades, urban birth rates have surged, outpacing rural birth rates, primarily due to the increasing urbanization trend observed across the nation.

To comprehend the prevailing trend of urban birth rates surpassing rural ones in Kazakhstan, it is essential to examine the broader context of urbanization within the country. Kazakhstan has experienced rapid urban growth, propelled by industrialization, economic development, and rural-to-urban migration [40,41]. As cities expand and attract more residents, they become epicentres of economic activity, educational opportunities, healthcare facilities, and social services, making them attractive destinations for young couples and families.

One of the key drivers of urban birth rates in Kazakhstan is access to healthcare services. Urban areas typically boast better-equipped hospitals, specialized medical facilities, and skilled healthcare professionals compared to rural regions [42]. Pregnant women in urban areas have easier access to prenatal care, maternal health services, and emergency obstetric care, which significantly contribute to safer pregnancies and childbirth outcomes [43]. The availability of modern medical technologies and interventions in urban hospitals further enhances the quality of maternal and neonatal healthcare, reducing the risks associated with childbirth complications and infant mortality [44,45].

In urban settings, individuals often have higher levels of education, employment opportunities, and income compared to

their rural counterparts. As a result, urban residents may delay marriage and childbearing to pursue higher education, establish careers, and achieve financial stability [46-48]. However, once they decide to start a family, urban couples may opt to have fewer children or plan childbirth more strategically to balance career aspirations and parenting responsibilities [49,50]. This trend towards delayed childbearing and smaller family sizes contributes to lower fertility rates in urban areas in all countries, including Kazakhstan [38,51].

Cultural shifts and changing societal norms also play a role in shaping birth rates in urban versus rural areas in all countries, including Kazakhstan. Urbanization is often accompanied by shifts in cultural attitudes towards family planning, gender roles, and child-rearing practices. In urban environments, there may be greater acceptance and utilization of modern contraceptive methods, family planning services, and reproductive health education [42,52]. Moreover, urban lifestyles characterized by higher levels of gender equality, women's empowerment, and individual autonomy may influence fertility preferences and decision-making regarding childbearing.

Infrastructure development and urban amenities also impact birth rates by shaping living conditions and quality of life in urban areas of Kazakhstan. Cities offer a wide range of amenities such as parks, recreational facilities, educational institutions, and cultural venues that enhance overall well-being and family satisfaction. Additionally, urban infrastructure includes essential services like water supply, sanitation, electricity, and transportation networks, which contribute to improved living standards and maternal-child health outcomes. The availability of childcare services, parental support programs, and early childhood education facilities in urban settings may further incentivize couples to raise families in urban areas [53-55].

Despite the dominance of urban birth rates in Kazakhstan, it is essential to acknowledge the persistent challenges and disparities that exist within urban and rural contexts [56]. Disparities in access to healthcare, education, employment, and social services persist between urban and rural areas, influencing reproductive choices and birth outcomes [57]. The dominance of urban birth rates over rural ones in Kazakhstan reflects the multifaceted impact of urbanization on demographic trends, reproductive behaviour, and maternal-child health outcomes [58]. Urbanization brings about socio-economic, cultural, and infrastructural transformations that shape fertility preferences, family dynamics, and reproductive choices [59]. In Kazakhstan, the reduction in the number of births in 2022 has sparked concerns as it marks a significant decline compared to the previous year. Notably, the urban population experienced a decrease of 9.5%, while the rural population saw a steeper decline of 11.7%.

One of the primary factors contributing to the decline in birth rates in both urban and rural areas of Kazakhstan is the ongoing demographic transition. Like many countries undergoing rapid modernization and urbanization, Kazakhstan is experiencing shifts in reproductive behaviour and family planning preferences. Urbanization brings about changes in lifestyle, economic opportunities, and social norms, influencing individuals' decisions regarding marriage, childbearing, and family size. As urbanization progresses, couples may delay marriage and childbearing to pursue education, career advancement, and financial stability, leading to lower fertility rates overall.

Economic factors also play a significant role in shaping fertility trends in Kazakhstan. Economic uncertainty, job instability, and financial concerns can deter couples from starting or expanding their families. The economic impact of the COVID-19 pandemic, including disruptions to employment, income loss, and heightened economic insecurity, may have exacerbated these concerns and contributed to the decline in birth rates observed in 2022 [60,61]. In rural areas of, where economic opportunities may be more limited compared to urban centres, financial constraints and resource shortages may further discourage couples from having children.

The decline in birth rates observed in 2022 has significant implications for Kazakhstan's demographic landscape and socio-economic development. A shrinking population size, coupled with an aging population, can pose challenges for sustaining economic growth, maintaining a productive workforce, and ensuring social welfare programs' sustainability. Addressing the root causes of declining birth rates, including economic instability, cultural shifts, and healthcare disparities, requires a multifaceted approach that encompasses policy interventions, social programs, and community engagement initiatives aimed at promoting family well-being, supporting parental aspirations, and creating an enabling environment for family formation and child-rearing.

The analysis, conducted on the period between 2017 and 2022, revealed notable trends in Kazakhstan's fertility and infant mortality rates, shedding light on the various factors influencing health dynamics in different regions, as well as urban-rural differences.

First, the data reflects an overall increase in fertility between 2017 and 2021, followed by a subsequent decline in 2022. These fluctuations in fertility rates were more pronounced in urban areas, where fertility rates were consistently higher than in rural areas. Specifically, fertility peaked in 2021 in urban areas and in 2020 in rural areas, indicating changes in fertility patterns over time.

Despite these fluctuations, there was no statistically significant decline in overall infant mortality rates over the study period. However, there were marked gender differences in infant mortality rates, with girls having lower mortality rates than boys. This finding highlights the need for targeted interventions to address the specific health needs and vulnerabilities of male infants.

Further analysis using a linear regression model revealed a strong inverse association between birth weight and infant mortality rates. For every gram of increase in birth weight, there was a corresponding decrease in infant mortality rates, highlighting the critical role of medical interventions targeting birth weight in improving neonatal survival rates.

Moreover, the study revealed significant regional differences in infant mortality rates in different regions of Kazakhstan. Kostanay region had the highest rate of infant mortality among low-birth-weight children, highlighting the need for targeted health interventions and resources in areas at increased

risk of mortality. Conversely, Almaty and Akmola regions demonstrated more favourable survival rates, indicating the potential impact of regional health care infrastructure and resources on newborn health outcomes.

Conclusion.

The analysis conducted on Kazakhstan's fertility and infant mortality rates from 2017 to 2022 provides significant insights into the healthcare landscape of the country. Throughout this period, distinct trends emerged, underscoring the influence of various factors on health dynamics across regions and urban-rural divides. An overarching pattern of fertility fluctuations was observed, characterized by an overall increase between 2017 and 2021 followed by a subsequent decline in 2022. Despite the fluctuations in fertility, no statistically significant decline in overall infant mortality rates was noted over the study period. However, gender disparities in infant mortality rates were evident, with girls exhibiting lower mortality rates compared to boys.

The findings of this study provide valuable insights into the multifaceted dynamics of fertility, infant mortality, and associated factors in Kazakhstan. Addressing gender disparities in infant mortality, promoting interventions to improve birth weight, and targeting health resources to high-risk areas are essential steps toward enhancing newborn health outcomes and ensuring equitable access to healthcare services nationwide. Kazakhstan must continue its commitment to prioritizing maternal and child health by investing in evidence-based interventions, strengthening primary healthcare services, improving healthcare accessibility in rural areas, and enhancing data collection and surveillance systems for informed decision-making and intervention planning.

Study limitations.

While the data offers insights into fertility and mortality rates across various regions of Kazakhstan, the analysis falls short of exploring the underlying reasons for regional disparities. Factors influencing birth weight, such as maternal age, smoking, alcohol consumption, and others, are notably absent from the discussion. These factors are crucial determinants that can significantly impact birth outcomes and subsequently influence infant mortality rates. Therefore, a more comprehensive examination that considers these factors is essential for gaining a deeper understanding of the dynamics driving fertility and mortality patterns across different regions of Kazakhstan.

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Conflicts of Interest.

The authors declare no conflict of interest.

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