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Health status of newborn children in megapolis

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ABSTRACT. Being the founders of two domestic schools of neonatology, Moscow and St. Petersburg make a significant contribution to the birth rate of our country. In order to assess the health status of newborns in the largest Russian cities, starting with the transition of the Russian Federation to the live birth criteria recommended by the WHO, the rates of birth of children with low, medium and high birth weight, neonatal morbidity, mortality and lethality of children in the first 168 hours of life were calculated and analyzed. Official statistics were used as the base material. It was revealed that in 2013–2023 in megacities, compared to the national indicators, children were born statistically significantly less often with a body weight of less than 2500 g and more often with a body weight of 4000 g or more. In St. Petersburg, the rate of birth of children with deviations in body weight exceeded similar rates in Moscow: low by 10.7%, extremely low by 19.3% and high by 8.1%. At the same time, in St. Petersburg, the rate of birth of children with a body weight of 500–999 g was 1.5–2.5 was 9.9% higher than the national average, and 7.9% lower in Moscow. Against the backdrop of a decrease in the incidence rates of newborns in Russia and Moscow (by 7.2 and 15.4%, respectively), an annual increase in rates was observed in St. Petersburg, which amounted to 115.6% for the period 2013–2023. On average, over the years studied, the incidence rates of newborns in St. Petersburg were higher than in Russia and Moscow by 13.0 and 32.6%, respectively, and the incidence of children in the first month of life in Moscow was 12.5% lower than the national average. During the period studied, both in the country as a whole and in St. Petersburg and Moscow, mortality and lethality of newborns in the first 168 hours of life decreased significantly. The level of early neonatal mortality and lethality in megalopolises was lower than in the country as a whole, but in Moscow, the mortality and lethality of newborn children exceeded the indicators in St. Petersburg by 11.5 and 22.2%, respectively. Thus, in St. Petersburg, with higher rates of birth of children with abnormal body weight compared to Moscow, the level of morbidity of newborns was significantly higher. At the same time, this excess did not have a negative impact on the reduction of mortality and lethality rates of newborns, which in megacities were significantly lower than in the country as a whole. The study showed that in modern conditions, a high level of quality of medical care for newborns, laid down by the founders of the Moscow and St. Petersburg schools of neonatology, is continuously maintained.

KEYWORDS: newborns, birth rate, body weight at birth, morbidity of newborns, early neonatal mortality, Moscow, St. Petersburg

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РЕЗЮМЕ. Являясь родоначальниками двух отечественных школ неонатологии, Москва и Санкт-Петербург вносят существенный вклад в рождаемость нашей страны. С целью проведения оценки состояния здоровья новорожденных крупнейших мегаполисов России, начиная с перехода Российской Федерации на критерии живорождения, рекомендованные Всемирной организацией здравоохранения (ВОЗ), были рассчитаны и проанализированы показатели частоты рождения детей с низкой, средней и высокой массой тела, заболеваемости новорожденных, смертности и летальности детей в первые 168 часов жизни. В качестве базового материала использовались данные официальной статистики. Выявлено, что в 2013–2023 гг. в мегаполисах, в сравнении с показателями по стране, статистически значимо реже рождались дети с массой тела менее 2500 г и чаще — с массой тела 4000 г и более. В Санкт-Петербурге частота рождения детей с отклонениями в массе тела превышала аналогичные показатели в Москве: с низкой — на 10,7%, экстремально низкой — на 19,3% и высокой — на 8,1%. В то же время в Санкт-Петербурге частота рождения детей с массой тела 500–999 г была выше на 9,9%, чем в среднем по стране, а в Москве ниже на 7,9%. На фоне снижения показателей заболеваемости новорожденных в России и Москве (на 7,2 и 15,4% соответственно) в Санкт-Петербурге наблюдался ежегодный рост показателей, который за период 2013–2023 гг. составил 115,6%. В среднем за изучаемые годы показатели заболеваемости новорожденных в Санкт-Петербурге были выше, чем в России и Москве на 13,0 и 32,6% соответственно, а заболеваемость детей первого месяца жизни Москвы была ниже среднероссийского уровня на 12,5%. В изучаемый период как в целом по стране, так и в Санкт-Петербурге и Москве, смертность и летальность новорожденных в первые 168 часов жизни значительно снижалась. Уровень ранней неонатальной смертности и летальности в мегаполисах был ниже, чем в целом по стране, но в Москве смертность и летальность новорожденных детей превышала показатели в Санкт-Петербурге на 11,5 и 22,2% соответственно. Таким образом, в Санкт-Петербурге при более высоких, по сравнению с Москвой, показателях частоты рождения детей с отклонениями в массе тела был значительно выше уровень заболеваемости новорожденных. Вместе с тем данное превышение не оказало негативного влияния на снижение показателей смертности и летальности новорожденных, которые в мегаполисах были значительно ниже, чем в целом по стране. Проведенное исследование показало, что в современных условиях поддерживается высокий уровень качества медицинской помощи новорожденным, заложенный основоположниками московской и петербургской школ неонатологии.

КЛЮЧЕВЫЕ СЛОВА: новорожденные, рождаемость, масса тела при рождении, заболеваемость новорожденных, ранняя неонатальная смертность, Москва, Санкт-Петербург

INTRODUCTION

Health status of children is a critical foundation for ensuring well-being of the state in future [1, 2]. It is no coincidence that the priority of children's health is one of the leading principles of health protection in our country. Given declining birth rates, protecting life and health of every new-born child has become particularly imperative [3]. Therefore, assessing the health status of newborn children is a strategic task facing the maternal and child health system. In contemporary healthcare, when ensuring the health of a newborn is inseparable the quality and effectiveness of care provided by gynecologists, neonatologists and pediatricians, the tasks of continuity and phased medical support to children of this age has become paramoun [4]. Our country has a three-tier system for organizing medical care. It fully meets the needs of the population for accessible and high-quality medical care, especially in the system of motherhood and childhood. The effort to secure a child's health begins even before his birth. However, to achieve its current standards, the maternal and child health care system has come a long way. Until almost the end of the 19th century, caring for newborns, including premature babies, was the mother's responsibility. Most children were born at home, without medical assistance, and, accordingly, mothers did not receive any recommendations on how to care for them. Under these conditions, the mortality rate of premature babies was very high, and in few institutions for children of that time, the mortality rate reached 85–95% [5].

Beginning in the XVIII century, Russia's first physicians began actively addressing challenges in obstetrics and examining the conditions under which children were born. Among these pioneers was S.G. Zybelin (1735–1802), who studied parental health (particularly that of pregnant women) as a critical factor in delivering healthy offspring. A prominent Russian medic and one of the first professors of medicine at Moscow University, Zybelin provided valuable guidelines on prenatal care, diet, and physical activity during pregnancy. He asserted that healthy childbirth depended on three key elements: the parents' health, the mother's desire to bear a child, and an uncomplicated (normal) pregnancy. Zybelin also identified several medical and social factors contributing to insufficient population growth, including celibacy, social upheavals, high mortality rates (especially among children), and widespread poverty [6].

Among the distinguished pediatricians of the Moscow school, G.N. Speransky made particularly significant contributions to newborn healthcare. In 1906, the eminent Moscow obstetrician A.N. Rakhmanov appointed him as pediatric consultant at the Maternity Hospital named after A.A. Abrikosova, where Rakhmanov served as director. In 1910, Speransky founded Moscow's first specialized medical facility for infants. His most notable achievement came between 1910 and 1912 with the establishment of the innovation "House of the Infant" (Dom grudnogo rebenka). This innovative institution comprised several pioneering facilities: Moscow's first maternal counselling center for infant care and feeding, the city's first inpatient hospital for sick children with an attached polyclinic, milk kitchen (formula preparation facility) and nursery (daycare for infants) [7].

Issues concerning newborns and premature infants received attention in every obstetrics manual published during the XIX and early XX centuries. However, specialized works focusing exclusively on children also were done. Among these, particular note should be made of Russia's first pediatrics textbook, Pediyatrika (1847). This seminal work was written by S.F. Khotovitsky, one of the founders of the St. Petersburg pediatric school. He was a Doctor of Medicine and Surgery, Associate Professor of the Department of Midwifery, Forensic Medicine and Medical Police, and later Full Professor of the Department of Obstetrics and General Studies of Women's and Children's Diseases at the Imperial Military Medical Academy. In the sections devoted to early childhood, Khotovitsky provides a detailed description of the newborn's condition immediately after birth and the physiological changes occurring during the first days of life [8].

A pivotal role in establishing the St. Petersburg school of neonatology belongs to V.P. Zhukovsky, who was the first pediatrician worked in our city's maternity institution. In 1897, he was invited by Professor A.Ya. Krassovsky, Director of the St. Petersburg Maternity Hospital, to head the neonatal department, ensuring more qualified and responsible care for newborns. This marked the first time a maternity hospital employed a specialist who could rightfully be called first neonatologist of Russia [9]. In 1901, another milestone for Russian neonatology was the establishment in St. Petersburg of a special Shel-

ter for Premature Infants, initiated by prominent pediatricians: N.P. Gundobin, Chair of Pediatrics at the Military Medical Academy, D.A. Sokolov and V.O. Hubert, Privatdozenten (associate professors). Through its work, the shelter demonstrated that with scientifically grounded methods and proper care, premature infants could survive and develop (however, more slowly than full-term babies), achieve normal developmental milestones over time, show no significant differences from term-born children. As E.E. Hartier emphasized, society and the state bear equal responsibility for premature infants as for any child requiring care and support.

Special recognition must be given to A.L. Vladykin (1870–1936), another founding figure of the St. Petersburg school of neonatology who made substantial contributions to establishing this medical specialty in Russia. A Doctor of Medicine and professor, Vladykin organized the Department for Newborns at the Imperial Clinical Obstetrics and Gynecology Institute (now the Research Institute of Obstetrics, Gynecology and Reproductology named after D.O. Ott) where he gave lectures on neonatal physiology and pathology. In 1912, Vladykin published a clinical-statistical study that included anthropometric parameters of newborns, mortality and stillbirth rates among both full-term and premature infants, and frequency and types of developmental anomalies, including correlations with maternal age. Vladykin also developed a classification system for neonatal diseases, primarily based on etiological principles. Furthermore, in 1909, he created a concise course on "Newborn Care", which became part of the curriculum for first-tier students at the St. Petersburg Imperial Obstetrics and Gynecology Institute [7].

The distinguished traditions of the St. Petersburg school of neonatology are closely tied to the establishment on January 7, 1925, of the Institute for Maternal and Infant Welfare, which later became the St. Petersburg State Pediatric Medical University. The institute was founded on the basis of the clinical hospital "In Commemoration of the Sacred Coronation of Their Imperial Majesties", which had been providing medical care to sick children since 1905. Among its founding organizers were Z.O. Michnik and A.N. Antonov, the authors of the institute's concept, V.O. Mochán, its first director, prominent physicians including A.Ya. Goldfeld,

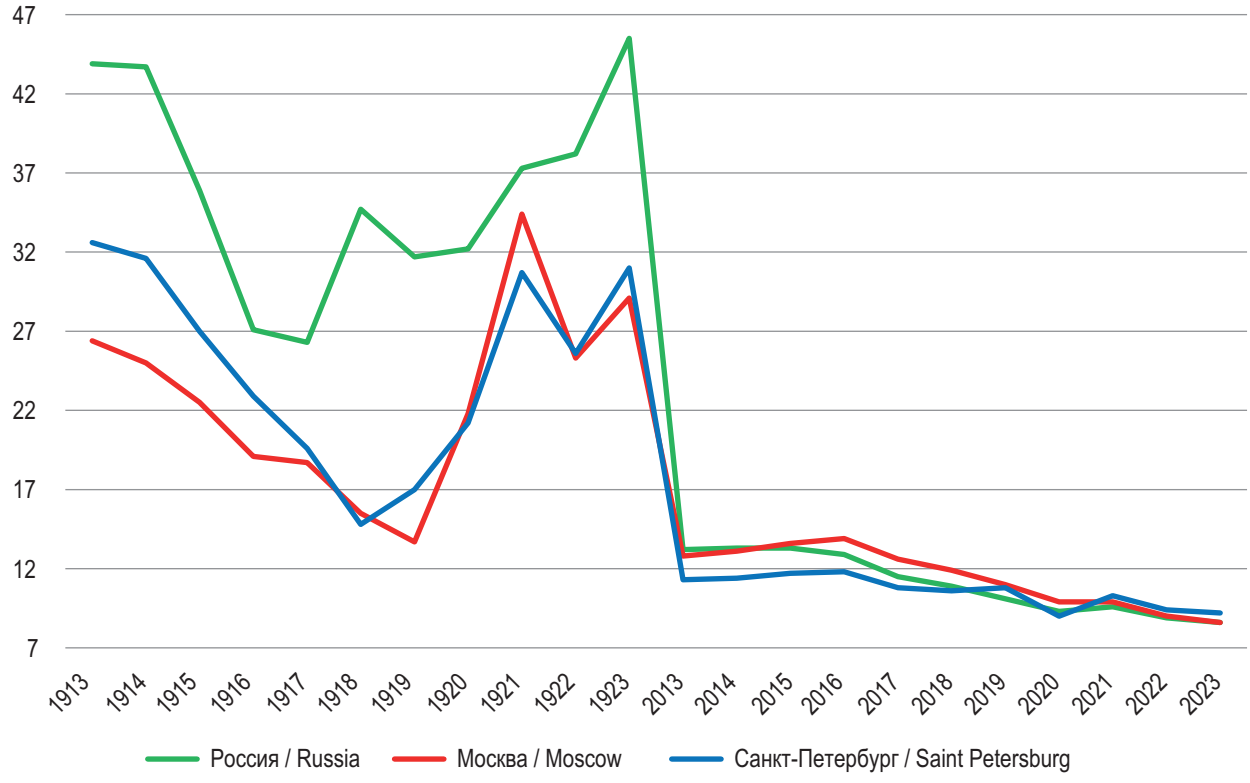

Fig. 1. Birth rate dynamics in Russia, Moscow and Saint Petersburg in 1913–1923 and 2013–2023 (per 1000 population)

Рис. 1. Рождаемость в России, Москве и Санкт-Петербурге в 1913–1923 гг. и 2013–2023 гг. (на 1000 населения)

M.S. Maslov, P.S. Medovikov, P.I. Lyublinsky, L.I. Erlikh, A.V. Popova, D.A. Solodukho, and L.L. Okinchits. A particularly significant role in the institute's development was played by its second director, Yulia A. Mendeleva (1883–1959). Under her uninterrupted leadership from its early days until 1949, including during the Siege of Leningrad, the institution was transformed into the Scientific Research Institute of Maternal and Infant Welfare (1928–1932) and pioneered the training of pediatricians directly from undergraduate medical education.

Returning to the present day, it should be noted that, as 100 years ago, the problems of insufficient population growth, noted by S.G. Zybelin, remain unresolved. An analysis of birth rates between 1913 and 1923 [10] reveals that major cities recorded significantly lower indicators compared to national averages (Fig. 1, Table 1), with socioeconomic and political challenges profoundly impacting these trends. In the modern context, low birth rates persist as a consequence of geopolitical transformations at the end of the last century. Consequently, revitalizing population growth has re-emerged as a critical challenge for our nation. Once again, Moscow and St. Petersburg are poised to lead this effort as flagship centers of national healthcare — particularly in neonatology. A special emphasis must be placed on St. Petersburg's role as a metropolis that continues to shape its distinguished school of neonatology and pediatrics at the St. Petersburg Pediatric Medical University, which will mark its 100th anniversary in 2025. The university's primary mission is reducing infant mortality, a priority advanced under the leadership of Chief Neonatologist of the Russian Ministry of Health, Doctor of Medicine, Professor D.O. Ivanov.

According to official statistics, St. Petersburg recorded 64,233 live births in 2013 and 48,016 live births in 2023 (a 25.2% decrease). Similarly, Moscow saw 134,881 live births in 2013 and

Table 1

Birth rate dynamics in Russia, Moscow and Saint Petersburg in 1913–1923 and 2013–2023 (per 1000 population)

Таблица 1

Динамика рождаемости в России, Москве и Санкт-Петербурге в 1913–1923 гг. и 2013–2023 гг. (на 1000 населения)

Год / Year	Российская Империя / СССР; XX век / Russian Empire / USSR; 20th century	Российская Федерация; XXI век / Russian Federation; 21st century	Темп прироста / снижения за 100 лет (раз) / Rate of increase / decrease over 100 years (times)	Петроград; XX век / Petrograd; 20th Century	Санкт-Петербург; XXI век / Saint Petersburg; XXI century	Темп прироста / снижения за 100 лет (раз) / Rate of increase / decrease over 100 years (times)	Москва; XX век / Moscow; 20th century	Москва; XXI век / Moscow; 21st Century	Темп прироста / снижения за 100 лет (раз) / Rate of increase / decrease over 100 years (times)
1913 / 2013	43,9	13,2	↓3,3	26,4	12,8	↓2,1	32,6	11,3	↓2,9
1914 / 2014	43,7	13,3	↓3,3	25,0	13,1	↓1,9	31,6	11,4	↓2,8
1915 / 2015	35,9	13,3	↓2,7	22,5	13,6	↓1,7	27,0	11,7	↓2,3
1916 / 2016	27,1	12,9	↓2,1	19,1	13,9	↓1,4	22,9	11,8	↓1,9
1917 / 2017	26,3	11,5	↓2,3	18,7	12,6	↓1,5	19,6	10,8	↓1,8
1918 / 2018	34,7	10,9	↓3,2	15,5	11,9	↓1,3	14,8	10,6	↓1,4
1919 / 2019	31,7	10,1	↓3,1	13,7	11,0	↓1,2	17,0	10,8	↓1,6
1920 / 2020	32,2	9,3	↓3,5	21,8	9,9	↓2,2	21,2	9,0	↓2,4
1921 / 2021	37,3	9,6	↓3,9	34,4	9,9	↓3,5	30,7	10,3	↓3,0
1922 / 2022	38,2	8,9	↓4,3	25,3	9,0	↓2,8	25,6	9,4	↓2,7
1923 / 2023	45,5	8,6	↓5,3	29,1	8,6	↓3,4	31,0	9,2	↓3,4
В среднем за 10 лет / On average over 10 years	36,0	11,1	3,4	22,9	11,5	2,1	24,9	10,6	2,4
Темп прироста / снижения / Rate of increase / decrease in (%)	↑3,6	↓34,8	–	↑10,2	↓32,8	–	↓4,9	↓18,6	–

120,620 live births in 2023 (a 10.6% decline) [11]. Metropolises play a pivotal role in shaping birth rate trends across Russia's North-Western (NWFD) and Central (CFD) federal districts, regions that currently exhibit the lowest population reproduction rates nationwide. Key findings for 2023 reveal: 44% of all births in the NWFD occurred in St. Petersburg and 37.6% of all births in the CFD occurred in Moscow. Nationally, metropolises accounted for 13.3% of Russia's total live births in 2023, a 1.3-fold increase since 2013 ($p < 0.05$). On average, in 2013–2023, the contribution of Moscow and St. Petersburg to the birth rate in Russia was 12.0%. Given Russia's persistent demographic decline and the outsized role of megacities in advancing neonatal care systems, evaluating newborn health outcomes in Moscow and St. Petersburg emerges as a critical research priority.

AIM

To assess the health status of newborn children in Russia's largest megacities, beginning from the period when the Russian Federation adopted the live birth criteria recommended by World Health Organization (WHO).

MATERIALS AND METHODS

The study used official statistical data and statistical reports from Rosstat and the Central Research Institute of Organization and Informatization of Healthcare of the Russian Ministry of Health for 2013–2024 [12–22]. The research period starting from 2013 was selected due to Russia's transition in 2012 to new live birth criteria recommended by WHO. Given that healthcare organizations' statistical reporting has been conducted according to new rules since 2013, an eleven-year observation period was established to evaluate neonatal service performance indicators. To assess the newborn health status, the study analyzed the following indicators calculated per 1,000 live births: frequency of births with body weight 500–999 g; frequency of births with body weight less than 2,500 g; frequency of births with body weight 2,500–3,999 g; frequency of births with body weight 4,000 g or more; and mortality within the first 168 hours of life. The research calculated and evaluated neonatal morbidity rates (per 1,000 live births) and early neonatal death rates (per 100 sick newborns) in the Russian Federation, Moscow, and St. Petersburg for 2013–2023. Indicator comparisons were made using visualization metrics. Spearman's rank correlation coefficient was applied to assess relationships between indicators of average birth weight and birth weight deviations. The significance of differences in quantitative indicators was evaluated using Student's t-test, with differences considered significant at $p < 0.05$. Statistical data processing was performed using MS Office 2019 and STATISTICA 10.0 (StatSoft) software packages.

RESULTS AND DISCUSSION

The assessment of a newborn's physical development is conducted in accordance with the current Order of the Russian Ministry of Health and Social Development No. 1687n dated December 27, 2011 (as amended on April 15, 2021) "On Medical Birth Criteria, Birth Certificate Forms and Procedures for Their Issuance" [23]. The birth weight of a child is determined by weighing the newborn within the first hour of life. Newborns are classified as follows: those weighing less than 2,500 g are considered low birth weight; less than 1,500 g — very low birth weight; less than 1,000 g — extremely low birth weight (ELBW); 2,500–3,999 g — normal birth weight; and 4,000 g or more — high birth weight.

The World Health Organization considers physical development indicators as one of the fundamental criteria for assessing the health of newborn children and has set a goal to reduce the number of low birth weight infants by 30% by 2025 [24]. Low birth weight children more frequently experience functional impairments, higher morbidity rates, often less favorable neurological outcomes, and increased risk of neonatal mortality [25]. Our study revealed that during 2013–2023, the incidence of low birth weight infants (<2500 g) in St. Petersburg was significantly lower than the national average ($p < 0.05$). Moscow similarly demonstrated lower rates compared to national levels, except in 2021 when the incidence substantially exceeded both Russian and St. Petersburg values. The study found that during the observation period, the average rates in Moscow and St. Petersburg were 13.1% and 4.3% lower, respectively, than the national average (60.28±0.39‰, $p < 0.05$). A comparative assessment between the two megacities revealed that St. Petersburg's mean rate of low birth weight infants (<2500 g) was 10.7% higher than Moscow's (57.72±0.30‰ vs 52.41±1.25‰;

p <0.05). Analysis of trends showed a 5.8% reduction in low birth weight frequency across the Russian Federation (p <0.05), with Moscow demonstrating an 11.1% decrease (p <0.05), and St. Petersburg showed a 0.2% reduction (p >0.05). The complete data on the incidence of low birth weight infants (<2500 g) in Russia, Moscow, and St. Petersburg are presented in Figure 2.

Numerous studies [25, 26] have established that physical development progression shows a direct correlation with birth weight. Newborns with extremely low birth weight demonstrate delayed anthropometric parameters and significantly higher prevalence of neurological and psychomotor impairments [27]. It was revealed that in St. Petersburg, with the exception of 2013 and 2022 (p>0.05), there was a higher frequency of births of children weighing 500–999 g than in the Russian Federation (Fig. 3). However, statistically significant differences were observed only in 2015, 2017, 2018 and 2021 (p <0.05). In 2013–2014, the birth rate of children with ELBW in Moscow was at the national average, and subsequently, with the exception of 2021, the birth rate of children with this body weight exceeded the national average. At the same time, statistically significant differences were observed from 2018 to 2023 (p <0.05). Comparative analysis of the indicators in megacities revealed that the frequency of births of children with ELBW in St. Petersburg exceeded Moscow's indicators, except for 2013 and 2021, while statistical differences between the indicators were observed in 2015, 2017–2020 and 2023 (p <0.05). It was found that the average indicator in St. Petersburg was higher than the national average by 9.9% (4.1±0.13‰ vs. 3.8±0.07‰; p <0.05) and the indicator in Moscow by 19.3% (4.1±0.13‰ vs. 3.5±0.16‰; p <0.05). Analysis of trends in the frequency of extremely low birth weight infants (500–999 g) revealed a decrease in the indicators in the Russian Federation by 2.7% (p> 0.05) and in Moscow by 13.5% (p < 0.05). In 2023, in St. Petersburg, compared to the 2013 level, the frequency of births of children with ELBW increased by 11.4% (p> 0.05).

Nowadays, the increased incidence of high birth weight infants represents a significant concern, as macrosomia substantially increases the risk of childbirth complications [28, 29]. St. Petersburg consistently demonstrated higher rates of

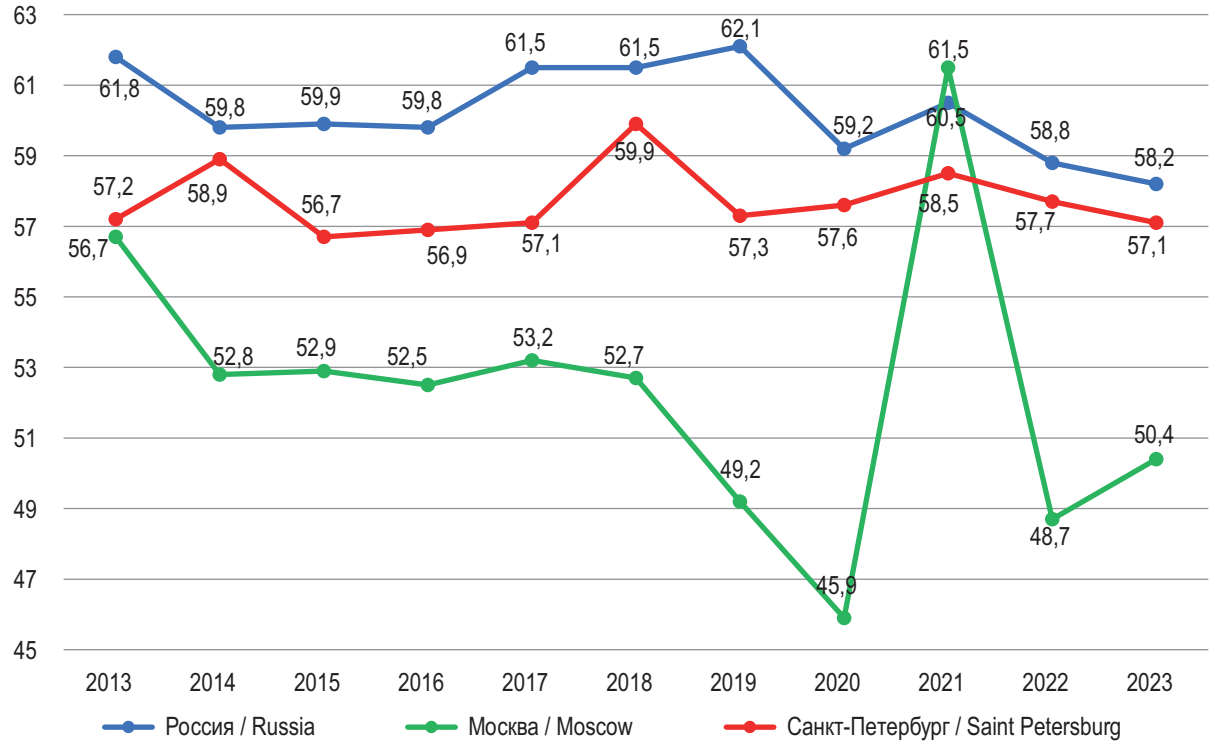

Fig. 2. Dynamics of the frequency of births of children with a body weight of less than 2500 g in Russia, Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 2. Динамика частоты рождения детей с массой тела менее 2500 г в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

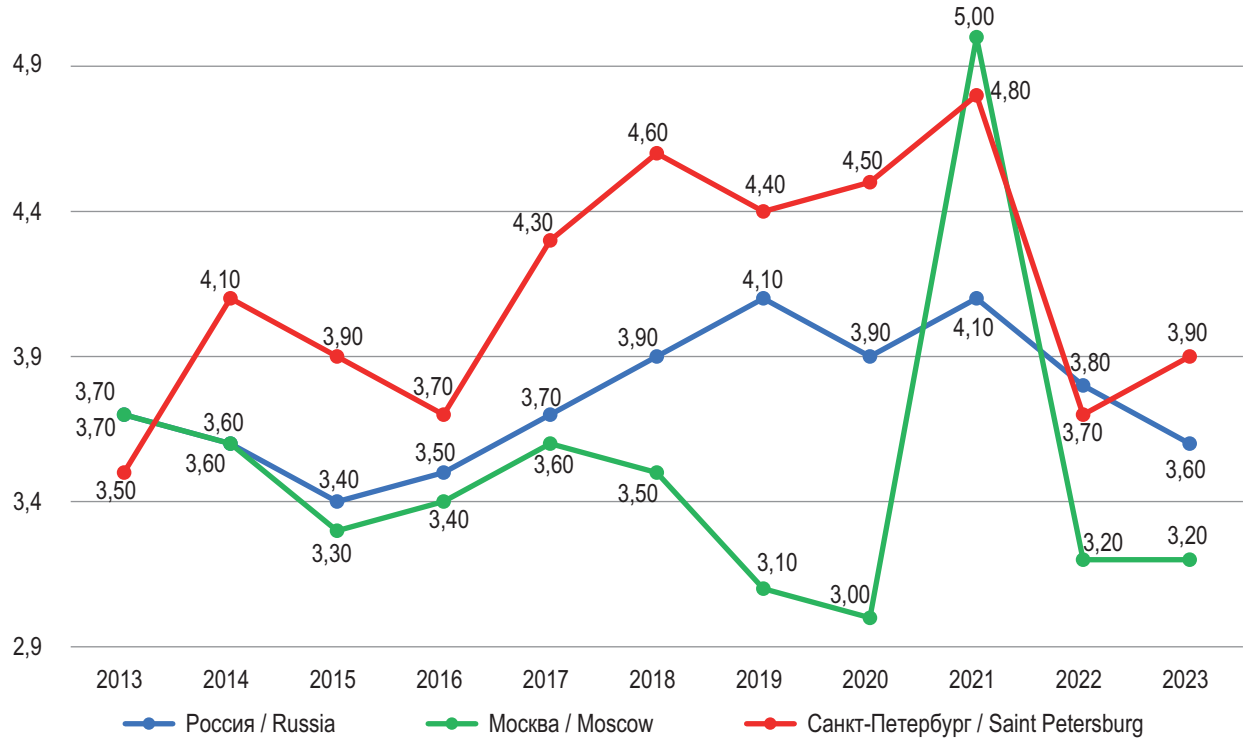

Fig. 3. Dynamics of the frequency of births of children with a body weight of 500–999 g in Russia, the Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 3. Динамика частоты рождения детей с массой тела 500–999 г в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

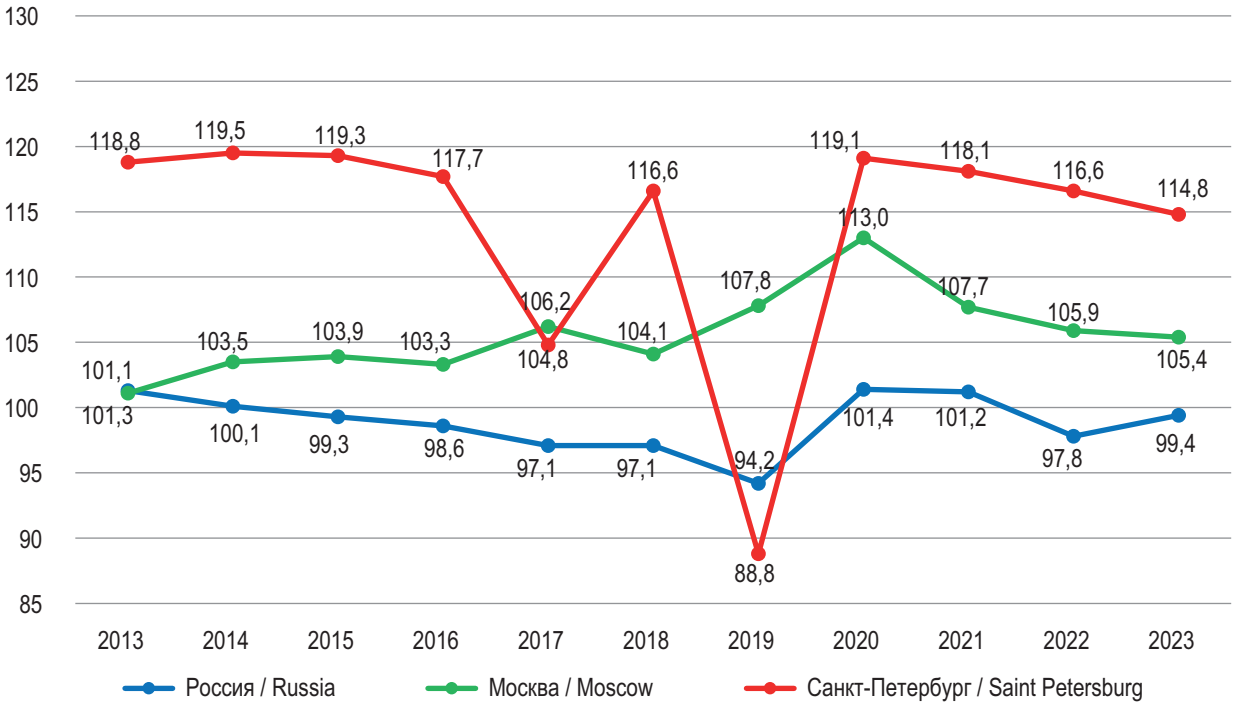

Fig. 4. Dynamics of the frequency of births of children weighing 4000 g and more in Russia, Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 4. Динамика частоты рождения детей с массой тела 4000 г и более в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

macrosomic births compared to both the national average and Moscow throughout nearly the entire study period (Fig. 4). A decrease in the frequency of births of children weighing 4000 g and above in St. Petersburg was observed in 2017, when the figures became lower than the Moscow values, and in 2019, when the frequency of births of children with high body weight was lower than the level not only in the capital, but also in Russia. Statistical analysis of the differences between indicators across Russia, St. Petersburg, and Moscow revealed significant variations ($p < 0.05$) throughout all years of the study period, with two exceptions: no statistically significant differences were found between Moscow and national Russian averages in 2013, nor between Moscow and St. Petersburg in 2017 ($p > 0.05$ for both comparisons). Analysis of high birth weight trends from 2013–2023 revealed significant regional variations. St. Petersburg maintained the highest prevalence at 114.0±1.29‰, significantly exceeding both Moscow (105.5±0.84‰; +8.1%, $p < 0.05$) and the national average (98.9±0.23‰; +15.2%, $p < 0.05$). In 2023, compared to the 2013 level, in Russia and St. Petersburg the indicators decreased by 1.9 and 3.4%, respectively ($p < 0.05$), and in Moscow they increased by 4.3% ($p < 0.05$).

The study showed that in St. Petersburg, compared to the Russian Federation and Moscow, in 2013–2023, children with average body weight were born significantly less frequently (Fig. 5). The peak increase in the frequency of births of children weighing 2500–3999 g in St. Petersburg was observed in 2017 and 2019. At the same time, statistically significant differences between the indicators in St. Petersburg and Moscow were not determined only in 2017 ($p > 0.05$). It was revealed that in Moscow, except for 2017, 2019 and 2021, the values of the frequency of normal birth weight infants were higher than in Russia as a whole, but a statistically significant difference between them was in 2013–2016 and 2021 ($p < 0.05$). At the same time, a statistically significant difference between the indicators in the two megacities remained throughout the entire observation period ($p < 0.05$), with the exception of 2017 ($p > 0.05$). It was found that the average rate of birth of children with an average body weight in St. Petersburg was lower than the average rate in Russia by

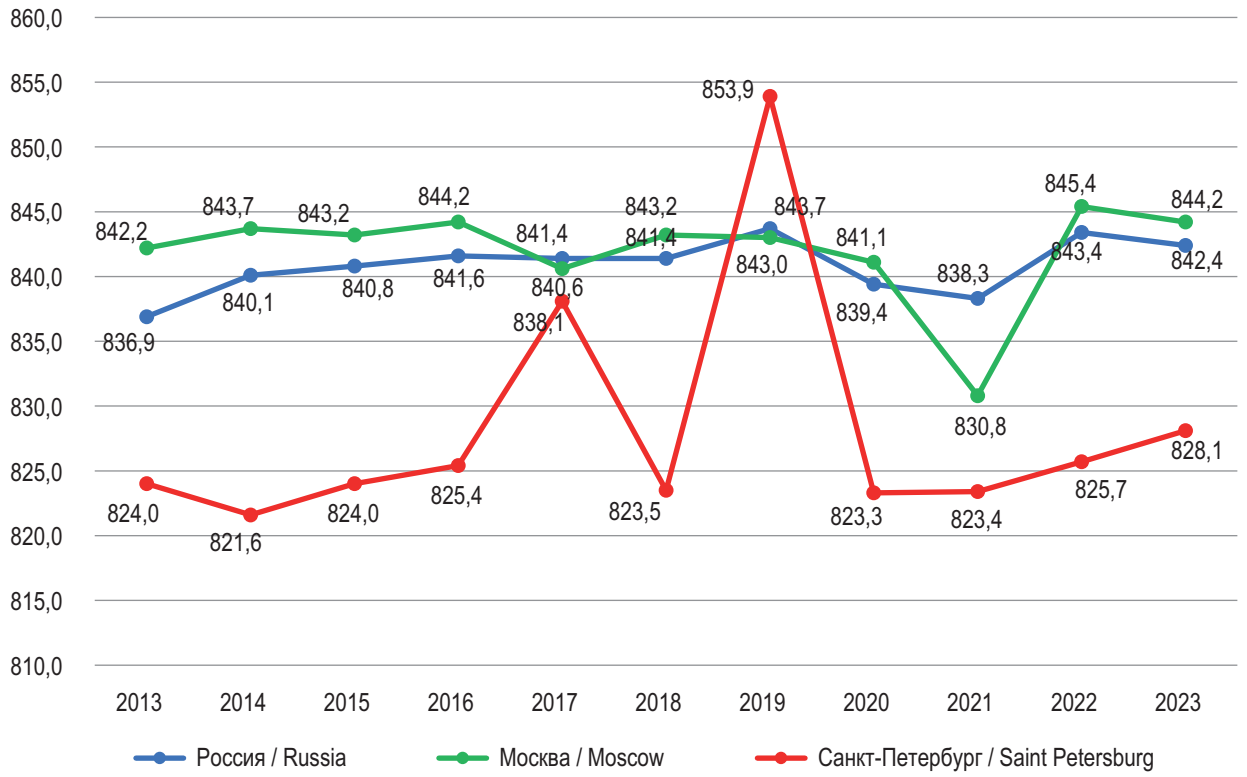

Fig. 5. Dynamics of the frequency of births of children with a body weight of 2500–3999 g in Russia, Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 5. Динамика частоты рождения детей с массой тела 2500–3999 г в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

1.5% (828.3±1.52‰ vs. 840.9±0.29‰; p <0.05) and the rate in Moscow by 1.6% (828.3±1.52‰ vs. 841.9±1.01‰; p <0.05). There were no statistically significant differences between the average rates in Russia and Moscow (p>0.05). The study showed that in 2023, compared to 2013, the rates of birth of children with a body weight of 2500–3999 g increased insignificantly (p >0.05): by 0.2% in Moscow and by 0.5% in St. Petersburg. In the country as a whole, the increase was 0.7%, but the change in rates was statistically significant (p <0.05).

According to A.A. Baranov and V.Yu. Albitsky, morbidity rates demonstrate the current socio-economic situation in a country or region, and also indirectly indicate the impact of climatic conditions, the level and availability of modern medical care for population [30]. That is, on the one hand, the morbidity rate of children in the first month of life depends on the level of diagnostics and is directly related to the availability of human, material and financial resources of healthcare organizations. On the other hand, the value of this indicator can be used to judge the level of health of newborns [31, 32]. Until 2017, St. Petersburg's neonatal morbidity rates were lower than both the national average and Moscow's; however, from 2018 onward, they rose significantly above both (p <0.05, Fig. 6). The morbidity rates of newborns, both in Moscow and St. Petersburg, grew until 2017, but since 2018 they began to decline annually. Moreover, statistically significant differences with the indicators for the Russian Federation were determined throughout the period 2013–2023, except for 2016 (p >0.05). Between 2013 and 2023, St. Petersburg's average neonatal morbidity rate was 13% higher than Russia's (353.7±1.94‰ vs. 315.00±0.36‰) and 32.6% higher than Moscow's (353.7±1.94‰ vs. 275.90±1.27‰). In St. Petersburg, the incidence rates of children in the first month of life increased by 2.2 times (p <0.05), while in the country as a whole and in Moscow they decreased by 7.2 and 15.4%, respectively (p <0.05).

The correlation between the birth rate of children with average body weight and with deviations in body weight (up to 2500 g, ELBW and 4000 g and more) was assessed. A strong inverse correlation was observed between the birth rates of average-weight and high-weight infants in Russia (r_{xy} = –0.82) and St. Petersburg (r_{xy} = –0.95), and in Moscow between average and low (r_{xy} = –0.70) was revealed.

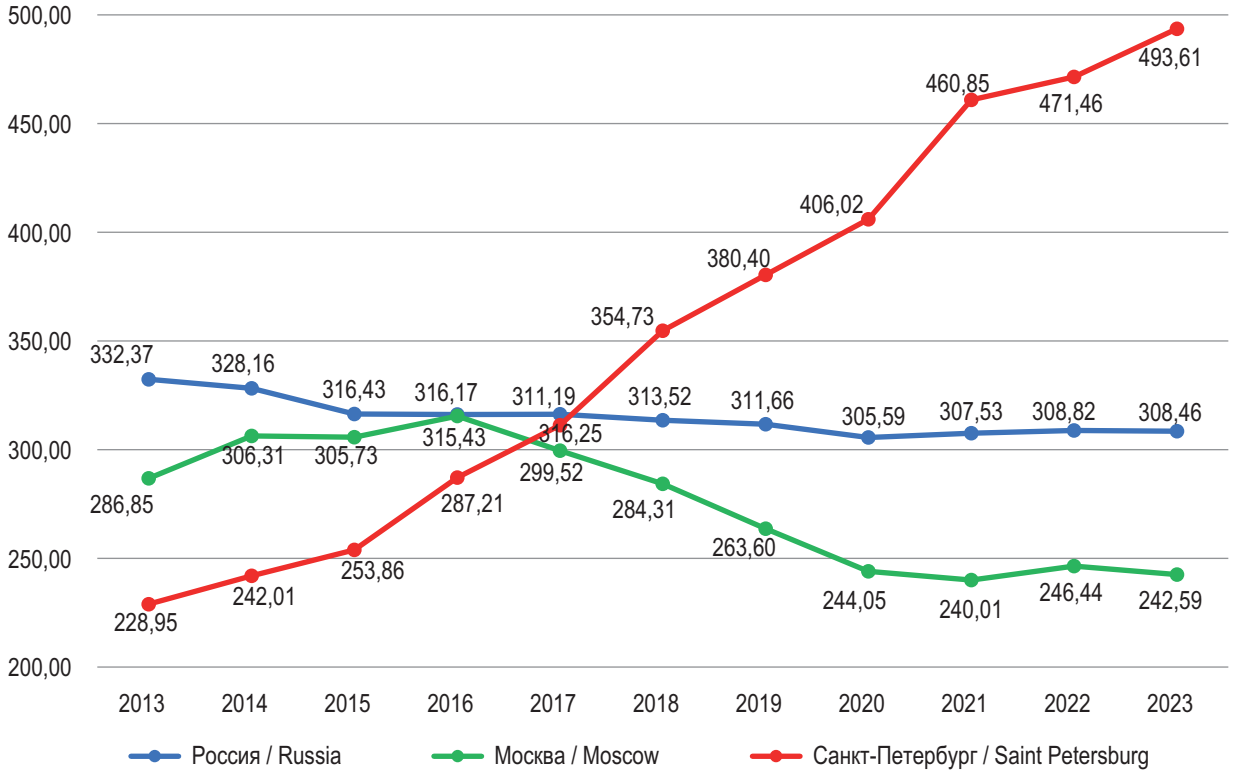

Fig. 6. Dynamics of morbidity in newborns in Russia, Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 6. Динамика заболеваемости новорожденных в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

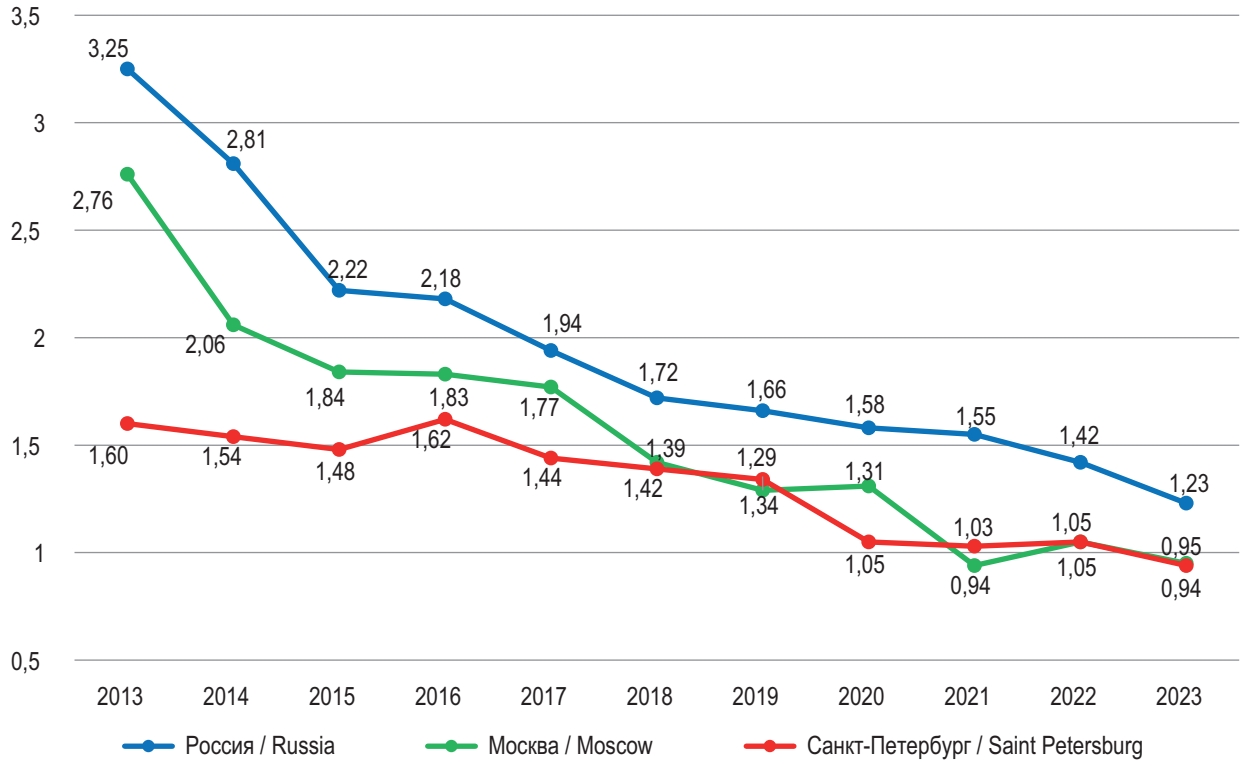

Fig. 7. Dynamics of early neonatal mortality in Russia, Moscow and Saint Petersburg in 2013–2023 (per 1000 live births)

Рис. 7. Динамика ранней неонатальной смертности в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 1000 родившихся живыми)

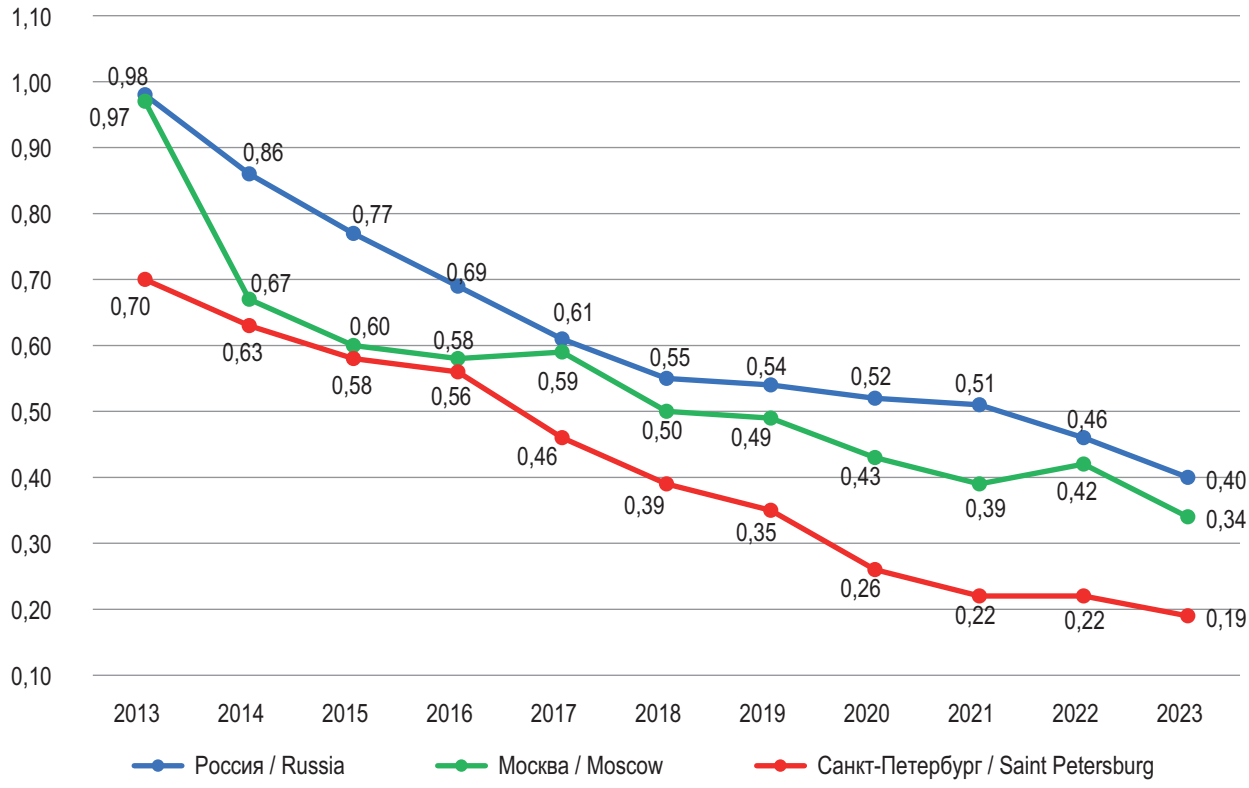

Fig. 8. Dynamics of neonatal mortality in Russia, Moscow and St. Petersburg in 2013–2023 (per 1000 sick births)

Рис. 8. Динамика летальности новорожденных в России, Москве и Санкт-Петербурге в 2013–2023 гг. (на 100 родившихся больными)

Preservation of life and health of children in a modern civilized society should be considered as a special humanitarian value, a promising resource for the economy and security of the country [1, 4]. Early neonatal mortality is the most important component of infant and perinatal mortality and one of the indicators of the quality of obstetric and neonatal care. Assessment of early neonatal mortality rates helps to identify problem areas in the healthcare system, determine priorities for improving medical care and develop target programs to reduce infant mortality [33]. Both in the country as a whole and in St. Petersburg and Moscow, mortality of children in the first 168 hours of life in 2013–2023 decreased (by 62.2, 65.6 and 41.3%, respectively; $p < 0.05$). In the country as a whole, there was an annual decrease in early neonatal mortality rates, and in St. Petersburg and Moscow in some years there were slight increases in rates ($p > 0.05$). The study revealed that the level of early neonatal mortality in megacities was lower than in the country as a whole. On average, over the studied years, the mortality rates of children in the first week of life in St. Petersburg were lower than in Russia by 30.5% (1.32±0.14‰ vs. 1.96±0.03‰; $p < 0.05$) and lower than in Moscow by 11.5% (1.32±0.14‰ vs.1.57±0.11‰; $p < 0.05$). The dynamics of early neonatal mortality in Russia, Moscow and St. Petersburg are presented in Figure 7.

Neonatal hospital mortality rate is a key indicator of the quality of medical care provided in obstetric facilities. This metric is influenced by the disease profile (nosological form) and the severity of the condition [4, 33]. The study found a significant decrease in early neonatal mortality, in the first week of life, across Russia, St. Petersburg, and Moscow (Fig. 8). During 2013 and 2023, mortality rates decreased by 2.4-fold in Russia, 2.9-fold in Moscow, and 3.7-fold in St. Petersburg ($p < 0.05$). On average, Russia's neonatal mortality rate (0.63±0.05%) was 1.2 times higher than Moscow's (0.54±0.05%; $p < 0.05$) and 1.5 times higher than St. Petersburg's (0.42±0.06%; $p < 0.05$).

CONCLUSION

1. In 2013–2023, in megacities, compared with the national average, children were born statistically significantly less frequently with a body weight of less than 2500 g and more frequently with a body weight of 4000 g or more.

2. In St. Petersburg, the frequency of births of children with abnormal body weight exceeded the figures in Moscow: with low weight by 10.7%, with ELBW by 19.3%, and with high weight by 8.1%. At the same time, in St. Petersburg, the frequency of births of children with ELBW was 9.9% higher than the national average, and in Moscow it was 7.9% lower.

3. In Russia and St. Petersburg, the decrease in the frequency of births of children with average body weight was associated with an increase in the frequency of births of children with high body weight, and in Moscow — with low body weight.

4. While there was a decrease in newborns' morbidity rates in Russia and Moscow (by 7.2 and 15.4%, respectively), in St. Petersburg an annual increase was observed, which for the period 2013–2023 was 115.6%. On average, over the years studied, the incidence of newborns in St. Petersburg was higher than in Russia and Moscow by 13.0 and 32.6%, respectively, and the incidence of children in the first month of life in Moscow was lower than the Russian average by 12.5%.

5. Both in the country as a whole and in St. Petersburg and Moscow, mortality and lethality of newborns in the first 168 hours of life decreased in 2013–2023. The level of early neonatal mortality and lethality in megacities was lower than in the country as a whole, and in Moscow, mortality and lethality of newborns exceeded the indicators in St. Petersburg by 11.5 and 22.2%, respectively.

Thus, in St. Petersburg, with higher rates of birth of children with abnormalities in birth weight, including ELBW, compared to Moscow, the level of morbidity of newborns was significantly higher. At the same time, this excess did not have a negative impact on the reduction of mortality and lethality rates of newborns, which in megacities were significantly lower than in the country as a whole. In Moscow, with a significantly lower morbidity of children in the first month of life, slightly higher mortality and lethality rates of children in the early neonatal period were observed. The study showed that in modern conditions, a high level of quality of medical care for newborns, laid down by the founders of the Moscow and St. Petersburg schools of neonatology, is maintained.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the concep-

tion of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that they have no competing interests.

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ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

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