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**Infant Mortality in the Chechen Republic: Comparative Analysis and Major Trends**

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***Background.*** *Despite the clear trend towards infant mortality decrease in our country, there are significant differences in values in some federal districts and regions of Russian Federation. Thus, the assessment of infant mortality rates and health indicators is crucial topic of scientific analysis.*  ***Objective. The aim of the study is to*** *investigate selected child health indicators and infant mortality rates in the Chechen Republic.* ***Methods.*** *We have conducted the retrospective cross-sectional study of infant mortality rates, prematurity incidence, infant and newborn morbidity, and mortality of children born sick or got sick. The study was based on the data from official statistics and from the extraction of statistical reporting forms №12 and №32.* ***Results.*** *The Chechen Republic belongs to the regions with high infant mortality rate, however, it has decreased by 11.6% from 6.9 to 6.1‰ in 2018-2022. The major diseases causing lethal outcomes in infants in this region, and in Russia as a whole, were certain conditions that occur in the perinatal period, and congenital disorders. Meanwhile, mortality from respiratory diseases and some infectious and parasitic diseases exceeded the national average. Prematurity incidence in the republic was 1.5 times lower than the national average, newborns morbidity was 1.7 times lower, infants morbidity was 4.0 times lower. Trend analysis has revealed that prematurity incidence and newborns morbidity have slightly changed over 5 years (+ 2.2% and − 1.0%), while infants morbidity had significant trend (− 40.2%). All morbidity rates of children who died at the age under 1 year were significantly lower than the national average for all classes of diseases that are the most common for infants mortality. The mortality rates among children born sick or got sick were on average 5.4 times higher than similar indicators in Russia. The highest mortality rate was observed among children who died from perinatal conditions, congenital disorders, external causes, and some infectious and parasitic diseases. The level of the maternal and child health service performance was 0.44 on average over the 5-year interval, that corresponds to the average level of efficacy.* ***Conclusion.*** *This study has allowed to reveal that there is an urge to improve the organization of medical care for infants in the Chechen Republic.*

***Keywords:*** *infant mortality, the Chechen Republic, prematurity incidence, infant morbidity, mortality, maternity and child welfare services efficacy*

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**Fig. 1.** Dynamics of infant mortality in Russian Federation and the Chechen Republic in 2013–2022 (per 1000 live births)

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Fig. 2.** Dynamics of infant mortality in Russian Federation and the Chechen Republic in 2018–2022, ‰

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Table 1.** Infant mortality from certain conditions in Russian Federation and the Chechen Republic in 2018–2022 (per 1000 live births)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Diseases class** | **Territorial unit** | **2018** | **2019** | **2020** | **2021** | **2022** | **Comparison between 2018 and 2022,**  **% (*р*)** |
| Perinatal conditions | RF | 2,56 | 2,54 | 2,37 | 2,35 | 2,19 | −14,4 (0,95) |
| CR | 3,37 | 2,95 | 3,75 | 3,76 | 2,49 | −26,2 (0,91) |
| Comparison, % (*р*) | ↑ 24,0  (0,02) | ↑ 14,1  (0,20) | ↑ 36,8  (< 0,001) | ↑ 37,4  (<0,001) | ↑ 12,0  (0,02) | – |
| CD | RF | 1,15 | 1,05 | 0,96 | 0,97 | 0,95 | −16,9 (0,865) |
| CR | 1,24 | 0,87 | 0,70 | 0,89 | 0,88 | −28,6 (0,97) |
| Comparison, % (*р*) | ↑ 7,1  (0,67) | ↓ 16,7  (0,30) | ↓ 27,0  (0,09) | ↓ 8,6  (0,65) | ↓ 7,6  (0,68) | – |
| Respiratory diseases | RF | 0,24 | 0,23 | 0,19 | 0,25 | 0,24 | – (–) |
| CR | 0,63 | 0,17 | 0,23 | 0,27 | 0,44 | −30,5 (0,98) |
| Comparison, % (*р*) | ↑ 62,3  (0,01) | ↓ 27,8  (0,44) | ↑ 18,4  (0,65) | ↑ 10,1  (0,65) | ↑ 45,0  (0,09) | – |
| Some infectious and parasitic diseases | RF | 0,23 | 0,19 | 0,16 | 0,18 | 0,21 | −9,2 (0,98) |
| CR | 0,30 | 0,23 | 0,23 | 0,27 | 0,41 | −26,6 (0,89) |
| Comparison, % (*р*) | ↑ 24,7  (0,49) | ↑ 17,4  (0,45) | ↑ 31,5  (0,43) | ↑ 35,4  (0,35) | ↑ 49,8  (< 0,001) | – |
| External causes | RF | 0,33 | 0,28 | 0,25 | 0,28 | 0,26 | −20,7 (0,95) |
| CR | 0,03 | 0,07 | 0,03 | 0,31 | 0,25 | −86,7 (0,93) |
| Comparison, % (*р*) | ↓ 90,0  (< 0,001) | ↓ 75,9  (< 0,001) | ↓ 86,5  (< 0,001) | ↓ 10,3  (0,78) | ↓ 4,8  (< 0,001) | – |
| Digestive system diseases | RF | 0,03 | 0,03 | 0,03 | 0,03 | 0,02 | −20,5 (0,99) |
| CR | 0,07 | 0,10 | 0,10 | – | 0,03 | −52,9 (0,87) |
| Comparison, % (*р*) | ↑ 55,2  (0,42) | ↑ 72,5  (0,24) | ↑ 73,0  (0,24) | –  – | ↑24,5  (< 0,001) | – |
| COVID-19 | RF | – | – | – | 0,05 | 0,05 | – |
| CR | – | – | – | 0,07 | 0,06 | – |
| Comparison, % (*р*) | – | – | – | ↑ 48,7  (< 0,001) | ↑ 26,0  (< 0,001) | – |

*Note.* RF (РФ) — Russian Federation; CR (ЧР) — Chechen Republic; PP (ПП) — perinatal period; CD (ВПР) — congenital defect.

**Fig. 3.** Prematurity incidence in Russian Federation and the Chechen Republic in 2018-2022 (per 1000 live births)

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Fig. 4.** Newborns morbidity in Russian Federation and the Chechen Republic in 2018-2022 (per 1000 live births)

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Рис. 5.** Dynamics of infants morbidity in Russian Federation and the Chechen Republic in 2018-2022 (per 1000 children under the age of 1 year)

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Table 2.** Morbidity of children died under the age of 1 year by disease classes with the highest mortality rate among children in Russian Federation and the Chechen Republic 2018–2022 (per 1000 infants)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Diseases class** | **Territorial unit** | **2018** | **2019** | **2020** | **2021** | **2022** | **Comparison between 2018 and 2022,**  **% (*р*)** |
| Some infectious and parasitic diseases | RF | 60,63 | 52,00 | 51,99 | 42,76 | 46,73 | −22,9 (< 0,001) |
| CR | 37,43 | 33,84 | 31,28 | 25,75 | 22,99 | −38,6 (0,04) |
| Comparison, % (*р*) | ↓ 38,3 (< 0,001) | ↓ 34,9  (0,001) | ↓ 39,8  (0,001) | ↓ 39,8  (0,002) | ↓ 50,8  (< 0,001) | – |
| Respiratory diseases | RF | 1282,34 | 1148,41 | 1248,51 | 1023,72 | 1118,44 | −12,8 (< 0,001) |
| CR | 358,01 | 319,09 | 306,01 | 328,47 | 252,91 | −29,3  (0,97) |
| Comparison, % (*р*) | ↓ 72,1  (< 0,001) | ↓ 72,2  (< 0,001) | ↓ 75,5  (< 0,001) | ↓ 67,9  (< 0,001) | ↓ 77,4  (< 0,001) | – |
| Digestive system diseases | RF | 147,48 | 125,16 | 153,26 | 111,89 | 111,60 | −24,3 (< 0,001) |
| CR | 81,05 | 69,57 | 48,30 | 21,92 | 23,43 | −71,1  (0,98) |
| Comparison, % (*р*) | ↓ 45,04  (< 0,001) | ↓ 44,42  (< 0,001) | ↓ 68,48  (< 0,001) | ↓ 80,41  (< 0,001) | ↓ 79,01  (< 0,001) | – |
| Perinatal conditions | RF | 256,58 | 244,19 | 299,20 | 226,29 | 217,11 | −15,4 (< 0,001) |
| CR | 70,13 | 57,36 | 40,86 | 64,33 | 22,64 | −67,7 (0,001) |
| Comparison, % (*р*) | ↓ 72,7 (< 0,001) | ↓ 76,5 (< 0,001) | ↓ 86,3 (< 0,001) | ↓ 71,6 (< 0,001) | ↓ 89,6 (< 0,001) | – |
| CD | RF | 88,11 | 90,07 | 109,90 | 91,10 | 97,68 | +9,8 (< 0,001) |
| CR | 19,70 | 17,98 | 16,06 | 23,36 | 19,30 | −2,0  (0,96) |
| Comparison, % (*р*) | ↓ 77,6 (< 0,001) | ↓ 80,0 (< 0,001) | ↓ 85,4 (< 0,001) | ↓ 74,4 (< 0,001) | ↓ 80,2 (< 0,001) | – |
| External causes | RF | 25,92 | 24,15 | 32,91 | 22,82 | 23,85 | −8,0 (0,001) |
| CR | 1,57 | 0,84 | 0,47 | 1,64 | 6,52 | +75,9 (0,45) |
| Comparison, % (*р*) | ↓ 93,9 (< 0,001) | ↓ 96,5 (0,001) | ↓ 98,6 (< 0,001) | ↓ 92,8 (0,001) | ↓ 72,7 (0,002) | – |
| COVID-19 | RF | – | – | 12,36 | 36,94 | 74,71 | – |
| CR | – | – | 0,57 | 1,81 | 5,38 | – |
| Comparison, % (*р*) | – | – | ↓ 95,4 (0,62) | ↓ 95,1 (< 0,001) | ↓ 92,8 (< 0,001) | – |

*Note.* RF (РФ) — Russian Federation; CR (ЧР) — Chechen Republic; PP (ПП) — perinatal period; CD (ВПР) — congenital defect.

**Fig. 6.** Infants mortality dynamics in Russian Federation and the Chechen Republic in 2018–2022 (per 100 sick infants)

Russian Federation

Polynomial (Russian Federation)

Chechen Republic

Polynomial (Chechen Republic)

**Table 3.** Infants mortality from certain diseases in Russian Federation and the Chechen Republic 2018–2022 (per 100 sick infants)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Diseases class** | **Territorial unit** | **2018** | **2019** | **2020** | **2021** | **2022** | **Comparison between 2018 and 2022,**  **% (*р*)** |
| Some infectious and parasitic diseases | RF | 0,37 | 0,38 | 0,28 | 0,41 | 0,44 | +53,8 (0,88) |
| CR | 0,80 | 0,10 | 0,75 | 1,06 | 1,78 | +55,1 (0,94) |
| Comparison, % (*р*) | ↑ 53,8 (0,562) | ↓ 73,7  (–) | ↑ 62,7  (0,897) | ↑ 61,3 (0,873) | ↑ 75,3  (0,892) | – |
| Respiratory diseases | RF | 0,02 | 0,02 | 0,01 | 0,02 | 0,02 | – |
| CR | 0,18 | 0,05 | 0,08 | 0,08 | 0,17 | −5,6 (0,99) |
| Comparison, % (*р*) | ↑ 88,9 (0,873) | ↑ 60,0 (0,976) | ↑ 87,5  (0,952) | ↑ 75,0  (0,953) | ↑ 88,2  (0,897) | – |
| Digestive system diseases | RF | 0,02 | 0,02 | 0,02 | 0,02 | 0,02 | – |
| CR | 0,08 | 0,14 | 0,21 | – | 0,13 | +38,5 (–) |
| Comparison, % (*р*) | ↑ 75,0 (0,984) | ↑ 85,7 (0,655) | ↑ 90,5 (0,952) | – | ↑ 84,6  (–) | – |
| Perinatal conditions | RF | 1,00 | 1,05 | 0,72 | 1,04 | 1,01 | +1,0 (0,98) |
| CR | 4,81 | 5,15 | 9,19 | 5,85 | 10,99 | +56,2 (0,14) |
| Comparison, % (*р*) | ↑ 79,2 (0,075) | ↑ 79,6 (0,086) | ↑ 92,2 (0,002) | ↑ 82,2 (0,040) | ↑ 90,8 (0,005) | – |
| CD | RF | 1,30 | 1,17 | 0,80 | 1,07 | 0,98 | −24,6 (0,41) |
| CR | 6,27 | 4,85 | 4,38 | 3,81 | 4,57 | −27,1 (0,77) |
| Comparison, % (*р*) | ↑ 79,3 (0,222) | ↑ 75,9 (0,396) | ↑ 81,7 (0,436) | ↑ 71,9 (0,478) | ↑ 78,6 (0,373) | – |
| External causes | RF | 1,29 | 1,15 | 0,75 | 1,21 | 1,11 | −14,0 (0,81) |
| CR | 2,13 | 8,00 | 7,14 | 18,75 | 3,86 | +44,8 (-) |
| Comparison, % (*р*) | ↑ 39,4  (–) | ↑ 85,6 (0,803) | ↑ 89,5  (–) | ↑ 93,5 (0,205) | ↑ 71,2 (0,704) | – |
| COVID-19 | RF | – | – | – | 0,13 | 0,06 | – |
| CR | – | – | – | 13,33 | 3,77 | – |
| Comparison, % (*р*) | – | – | – | ↑ 99,0 (0,698) | ↑ 98,4 (0,850) | – |

*Note.* RF (РФ) — Russian Federation; CR (ЧР) — Chechen Republic; PP (ПП) — perinatal period; CD (ВПР) — congenital defect.

**Table 4.** Post-neonatal infant mortality in Russian Federation (as a whole) and in Chechen Republic in 2018–2022 (per 1000 live births)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Post-neonatal infant mortality** | | | **Rate in infant mortality** | | |
| **Russian Federation** | **Chechen Republic** | **Comparison,**  **%** | **Russian Federation** | **Chechen Republic** | **Comparison,**  **%** |
| **2018** | 2,4 | 2,9 | ↓ 19,0 | 46,1 | 42,0 | ↓ 8,8 |
| **2019** | 2,2 | 3,0 | ↑ 26,6 | 45,5 | 54,3 | ↑ 16,2 |
| **2020** | 1,9 | 2,3 | ↑ 17,3 | 42,4 | 37,9 | ↓ 10,8 |
| **2021** | 2,1 | 2,6 | ↑ 19,4 | 45,2 | 38,5 | ↓ 14,8 |
| **2022** | 2,1 | 3,7 | 41,7 | 48,6 | 60,2 | ↑ 19,2 |

**Fig. 7.** Efficacy ratio of maternity and child welfare services in Russian Federation and the Chechen Republic in 2018–2022

Russian Federation

Chechen Republic

**RESEARCH LIMITATIONS**

We considered only data from infants and not from the entire pediatric population when we were calculating the children health indicators.

**FINANCING SOURCE**

Not specified.

**DISCLOSURE OF INTERESTS**

Not declared.

**AUTHORS CONTRIBUTION**

**Dmitry O. Ivanov** — concept development, project administration, scientific management.

**Karina E. Moiseeva** — concept development, study methodology design, manuscript draft writing, manuscript editing.

**Kazbek S. Mezhidov** — concept development, data processing, manuscript draft writing

**Vadim K. Yuriev** — project administration, scientific management.

**Anna V. Alekseeva** — study results visualization, manuscript editing.

**Kseniya G. Shevtsova** — data analysis, manuscript draft writing, manuscript editing.

**Vyacheslav M. Bolotskikh** — manuscript editing, data analysis.