Assessment of newborn health

dynamics after the Russian Federation transition to international criteria for live births and stillbirths

Evaluación de la dinámica de la salud del recién nacido después de la transición de la Federación de Rusia a los criterios internacionales para nacidos vivos y mortinatos

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Abstract

To assess the state of children's health in obstetric care organizations after Russia transition to international statistics on live births and stillbirths, we studied the main indicators of newborn health in the dynamics from 2013 to 2020. It was found that between 2013 and 2020 the morbidity of newborns decreased by 6.3% (from 337.2‰ to 316.3‰; p<0.05), neonatal mortality by 45.7% (from 3.5‰ to 1.9‰; p<0.05), stillbirth rate by 45.6% (from 10.9‰ to 5.5‰; p<0.05), and hospital mortality of newborns born sick and ill by 40.0% (from 1.0% to 0.6%; p<0.05). Assessment of the distribution of live-born infants by birth weight showed that changes in this parameter of physical development during the period under study had no statistically significant differences (p>0.05). The assessment of the impact of the COVID-19 pandemic on newborn health revealed slight shifts in the distribution of children born alive by birth weight and a 6.8% increase in the stillbirth rate compared to the pre-pandemic level. Thus, in the period from 2013 to 2020 the share of children discharged from obstetric hospitals who were healthy has increased due to the reduction in morbidity and mortality of newborns. The analysis showed that there was an improvement in the health indicators of newborns in the Russian Federation.

Keywords: newborns; obstetric care organizations; birth weight; neonatal morbidity; neonatal mortality; stillbirth rate; hospital mortality.

Resumen

Para evaluar el estado de la salud de los niños en las organizaciones de atención obstétrica después de la transición de Rusia a las estadísticas internacionales sobre nacidos vivos y mortinatos, estudiamos los principales indicadores de salud del recién nacido en la dinámica de 2013 a 2020. Se encontró que entre 2013 y 2020 la morbilidad de los recién nacidos disminuyó un 6,3% (de 337,2‰ a 316,3‰; p<0,05), la mortalidad neonatal un 45,7% (de 3,5‰ a 1,9‰; p<0,05), la tasa de mortinatalidad un 45,6% (de 10,9‰ a 5,5‰; p<0,05), y la mortalidad hospitalaria de los recién nacidos enfermos en un 40,0% (del 1,0% al 0,6%; p<0,05). La evaluación de la distribución de los nacidos vivos según el peso al nacer mostró que los cambios en este parámetro de desarrollo físico durante el período de estudio no tuvieron diferencias estadísticamente significativas (p>0,05). La evaluación del impacto de la pandemia de COVID-19 en la salud de los recién nacidos reveló ligeros cambios en la distribución de niños nacidos vivos por peso al nacer y un aumento del 6,8 % en la tasa de mortinatalidad en comparación con el nivel previo a la pandemia. Así, en el período de 2013 a 2020 aumentó la proporción de niños egresados de hospitales obstétricos que estaban sanos debido a la reducción de la morbilidad y mortalidad de los recién nacidos. El análisis mostró que hubo una mejora en los indicadores de salud de los recién nacidos en la Federación Rusa.

Palabras clave: Recién Nacidos; Organizaciones De Atención Obstétrica; Peso De Nacimiento; Morbilidad Neonatal; Mortalidad Neonatal; Tasa De Muerte Fetal; Mortalidad Hospitalaria.

Introduction

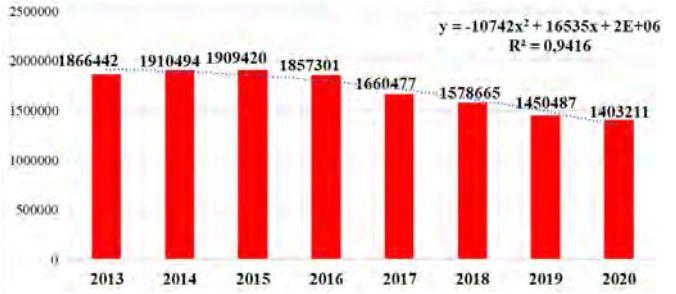
The main goal of the maternal and child welfare system is to preserve the life and health of every child[1-3]. The health of the child population is a powerful and essential resource that can become a prerequisite for the future socio-economic well-being of the state[4-6]. It is no coincidence that the priority of children's health is one of the basic principles of health care in the Russian Federation and in most countries of the world. In this context, the perinatal and neonatal periods are of particular demographic importance as a reserve for increasing the survival and health of the new generation[7-9].

The development of perinatology and neonatology in Russia has a long history and has undergone significant changes. After the collapse of the USSR in 1992, the Russian Federation developed instructions on the definition of live births, stillbirths, and perinatal period criteria for international comparability of national statistics [10]. These changes were directly linked to the International Convention on the Rights of the Child, the Declaration on the Survival, Protection, and Development of Children, and were strongly recommended for implementation by the World Health Organization (WHO)[11]. These guidelines included: management of premature births at 22 weeks of gestation and beyond; intensive care and nursing of very low and extremely low birth weight infants; an autopsy of stillborn and deceased infants weighing 500 to 1,000 grams.

However, the real transition to international statistics was made only in 2012, and in 2013 the system of registration of live births and stillbirths, recommended by the WHO, came into force. Before that, in Russia, the perinatal period was calculated from 28 weeks of pregnancy, including the period of childbirth, and ended after seven full days of the newborn's life[12,13]. According to the new legal framework, live birth is when the fetus separates from the mother through childbirth at 22 weeks of gestation or more with a birth weight of 500 grams or more (or less than 500 grams for multiple births) or if the child's birth weight is unknown, and if the newborn is 25 cm or more in length and the newborn shows signs of live birth (breathing, heartbeat, pulsation of the umbilical cord or voluntary muscular movements, regardless of whether the umbilical cord is cut and whether the placenta is detached). Stillbirth is when the fetus separates from the mother through childbirth at 22 weeks of gestation or more, and the newborn weighs 500 grams or more (or less than 500 grams in multiple births) or if the child's birth weight is unknown and the newborn is 25 cm or more in length and the newborn shows no signs of being born alive[14,15].

According to official statistics, since 2014, there has been an annual decrease in the number of children born alive in obstetric hospitals of the Russian Federation. While in 2013, 1866424 children were born, in 2020, the total number of children born alive decreased by 24.8% (to the level of 2013) and amounted to 463231. The dynamics of the absolute number of children born alive over the eight years under study are shown in Figure 1.

Figure 1. Dynamics of the number of children born alive in obstetric institutions of the Russian Federation in 2013-2020 (in abs.)



The medical care organization for newborns in Russia is based on the principles of continuity of obstetric and pediatric services. The main task of obstetric care organizations is to discharge home a healthy baby, so the analysis of indicators characterizing the state of health of newborns - morbidity, physical development, and mortality - is important in assessing the activities of the entire system of maternal and child health care. In the context of declining birth rates and the impact of the COVID-19 pandemic on public health, assessment of the dynamics of newborn health indicators since Russia's transition to the international system of live births and stillbirths is a relevant topic for research.

Thus, this study aimed to assess the health status of children in obstetric care organizations after Russia transition to international statistics on live births and stillbirths in the dynamics from 2013 to 2020.

Materials and Methods

This study analyzed the official statistical reports and publications of the Federal State Statistics Service for 2013-2019, compilations of "Basic Indicators of Maternal and Child Health and Activities of Childhood and Obstetric Care Services in the Russian Federation" of the federal state budget institution "Central Research Institute for Organization and Informatization of Healthcare" of the Ministry of Health of Russia for 2013-2020[16-20].

To assess the state of health of newborns in the Russian Federation, we studied morbidity rates and calculated and analyzed mortality rates of children in obstetric care organizations. To assess the physical development, the distribution of newborns born alive by birth weight was taken. The child's birth weight was considered the result of weighing the newborn within the first hour of its life. Newborns born weighing up to 2500 grams were classified as low birth weight babies, those weighing up to 1500 grams were classified as very low birth weight babies, and those weighing up to 1000 grams were classified as extremely low birth weight babies (ELBW). As additional criteria, the study of stillbirth rates was conducted and the calculation and analysis of hospital mortality of children born sick and ill. Proceeding from the fact that the main goal of the neonatology service of obstetric care

organizations is to preserve the health of each child born, we calculated the indicators and analyzed the dynamics of the proportion of healthy children discharged from obstetric care organizations in the period from 2013 to 2020.

To assess the significance of differences in quantitative indicators, in the case of a normal distribution, Student's t-test was used. The relationship of quantitative indicators was studied using Pearson's linear correlation coefficient qualitative indicators using Pearson's χ2 criterion. Formation of databases and visualization of the results was carried out with the help of the MS Office-2016 application software package (Word, Excel). Mathematical and statistical support was performed using a software package developed by StatSoft-Statistica 10.0.

Results and Discussion

To assess the state of health of newborns in obstetric care organizations, it is customary to calculate the index of child morbidity. Many factors influence the level of newborn morbidity. New technologies of care for premature newborns diagnostic and resuscitation capabilities lead to a significant increase in the survival rate of deeply premature babies, so therefore, they can cause an increase in neonatal morbidity. In 2020, per 1,000 live-born infants with a bodyweight of 1,000 g or more in Russian obstetric institutions, 316.3 children were born sick and became ill (Figure 2).

Figure 2. Morbidity of newborns in obstetric organizations of the Russian Federation in 2013-2020 (per 1000 live births)

Analysis of the dynamics of morbidity of newborns born alive for the period from 2013 to 2020 showed a clearly expressed annual downward trend. During this period, the number of sick and diseased children per 1000 live births decreased by 6.3% or 1.1 times (from 337.2‰ to 316.3‰; p<0.05).

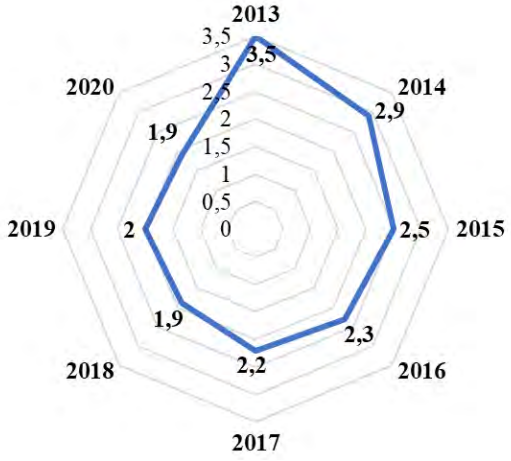
Evaluation of the physical development of newborns is one of the important indicators needed to monitor the system of medical care arrangements for newborns. Assessment of the distribution of newborns born alive by birth weight showed that on average in the Russian Federation in 2020 the proportion of children born with low birth weight was 5.93%, including 1.04% with very low birth weight and 0.39% with ELBW (Table 1). The average weight range was 83.93% of children, and the high range was 10.14%. Analysis of the distribution of live births by birth weight showed that in the pre-pandemic year of 2019 the share of newborns born alive with very low and extremely low birth weight increased by 3.8% and 5.1%, respectively, and the share of newborns born with high birth weight decreased by 7.2%. However, in 2020 the indicators of the share of children born alive with a birth weight of up to 1,500 grams and with a birth weight of 4,000 grams and more practically returned to the level of 2013, and the positive dynamics remained only for newborns with extremely low birth weight. In addition, the proportion of children born in the low-birth-weight segment up to 2500 grams in 2020 decreased by 3.5% relative to the 2013 level. However, changes in the distribution of children born alive by birth weight in 2013-2020 had no statistically significant difference (p>0.05).

Table 1. Dynamics of the share of newborns born alive by birth weight in the Russian Federation in 2013-2020 (as a percentage of live births)

Years	as a percentage of live births					
	Low weight	Very low weight	ELBW	Average weight	High weight	Total
2013	6.15	1.02	0.37	83.72	10.13	100.0
2014	6.03	1.01	0.36	84.24	9.73	100.0
2015	5.95	0.96	0.30	84.38	9.67	100.0
2016	5.98	0.99	0.35	84.43	9.59	100.0
2017	6.15	1.03	0.37	84.14	9.71	100.0
2018	6.16	1.05	0.39	84.11	9.73	100.0
2019	6.21	1.08	0.40	84.39	9.40	100.0
2020	5.93	1.04	0.39	83.93	10.14	100.0

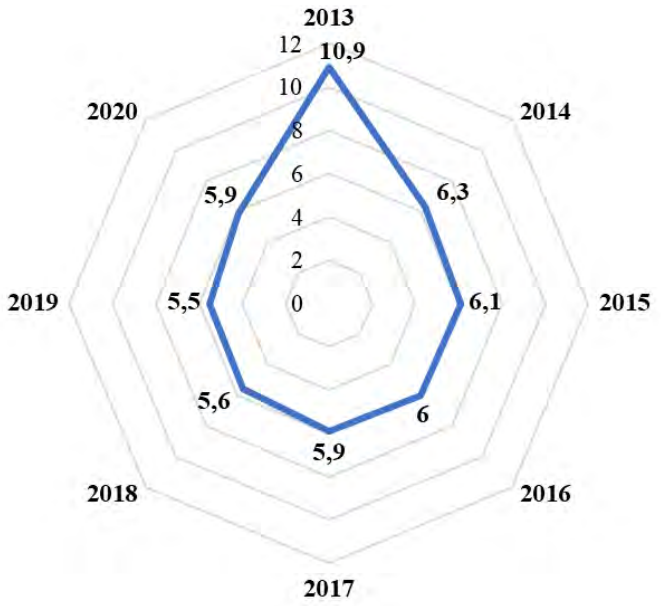
Reducing the mortality rate of newborns is a key task in reducing the mortality of the entire child population. This fact necessitates the improvement of medical care for newborns in obstetric hospitals. It was found that the neonatal mortality rate in obstetric organizations of the Russian Federation decreased annually in 2013-2020 (Figure 3). In 2020 it reached the level of 1.9 newborns per 1000 live births against 3.5 children per 1000 live births in 2013 (p<0.05). Thus, the negative trend was 45.7% or 1.8 times (from 3.5‰ to 1.9‰; p<0.05).

Figure 3. Dynamics of newborn mortality in obstetric organizations of the Russian Federation in 2013-2020 (per 1000 live births)



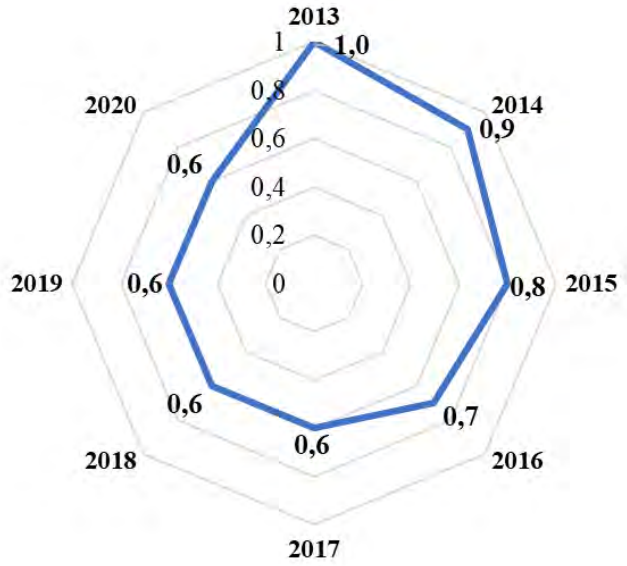
A comprehensive analysis of child mortality rates in obstetric hospitals in Russia should include an assessment of such indicators as stillbirth rates and mortality of newborns born sick and ill. Estimates of stillbirth rates are especially important for examining the possible statistical overflow of severely premature babies after birth into the category of infants born dead. Evaluation of stillbirth rates in obstetric care organizations showed that, like mortality of newborns born alive, the rates decreased annually from 2013 to 2019 (from 10.9‰ to 5.5‰; $p<0.05$), but slightly increased to 5.9‰ in 2020. Despite an increase in the stillbirth rate in 2020, the overall decline over the studied eight years was 45.6% or 1.8 times ($p<0.05$) (Figure 4).

Figure 4. Dynamics of stillbirth rate in obstetric organizations of the Russian Federation in 2013-2020 (per 1000 stillbirths)



Among all the performance indicators of obstetric care organizations, the indicator of hospital mortality of newborns born sick and ill has the greatest importance for assessing the quality of medical care for newborns. This indicator can indicate the level of medical care for newborns in obstetric organizations, considering the use of modern medical technologies for nursing babies. In the period from 2013 to 2016, the mortality rate of newborns born sick and ill in obstetric organizations of the Russian Federation decreased from 1.0% to 0.6% and did not exceed this level in the next four years ($p<0.05$). The dynamics of hospital mortality of newborns in obstetric organizations of the Russian Federation are shown in Figure 5.

Figure 5. Dynamics of hospital mortality of newborns in obstetric organizations of the Russian Federation in 2013-2020 (per 1000 childbirths)



The assessment of the neonatology service in obstetric organizations in the Russian Federation showed that in the period from 2013 to 2020 (Table 2), the proportion of healthy children discharged from obstetric institutions was about two-thirds of all newborns born alive.

Table 2. Selected results of the neonatology service in obstetric institutions in the Russian Federation in 2013-2020 (in abs. and % of live births)

Year	Born alive	Died	% of dead	Total number of children sick	% of ill children	Discharged healthy newborns	%
2013	1864059	6498	0.34	630113	33.8	1247248	66.9
2014	1907937	5567	0.29	637518	33.4	1264852	66.3
2015	1907491	4792	0.25	614063	32.2	1288636	67.6
2016	1855486	4306	0.23	597155	32.2	1254025	67.6
2017	1658746	3566	0.21	534554	32.2	1120626	67.6
2018	1577062	3001	0.19	502993	31.9	1071068	67.9
2019	1448804	2838	0.19	461586	31.9	984380	68.0
2020	1403211	2614	0.18	438984	31.3	964227	68.7

Correlation analysis revealed a direct strong correlation between the proportion of dead newborns and the proportion of children born sick and ill ($r_{xy}=0.95$), the inverse strong relationship between the proportion of dead newborns and the proportion of healthy newborns ($r_{xy}=-0.84$), and the inverse strong relationship between the proportion of children born sick and ill and the proportion of healthy newborns ($r_{xy}=-0.92$). Accordingly, between 2013 and 2020, the share of children discharged from obstetric hospitals who were healthy increased due to lower morbidity and mortality rates.

Assessment of the distribution of newborns in the Russian Federation (the ratio of deaths, those born sick, diseased, and healthy to those born alive) allowed us to establish that

the relationship between the factor and the outcome traits is statistically significant and not random, indicating an improvement in child health indicators from 2013 to 2020 ($\chi 2=23.685$; $p<0.05$).

Conclusions

1. The overall decrease in newborn morbidity between 2013 and 2020 was 6.3% (from 337.2‰ to 316.3‰; $p<0.05$).
2. Assessment of the distribution of live birth weight at birth showed that changes in this parameter of physical development in 2013-2020 had no statistically significant differences ($p>0.05$).
3. During the study period, the mortality rate of live births in obstetric organizations of the Russian Federation decreased by 45.7% (from 3.5‰ to 1.9‰; $p<0.05$).
4. The stillbirth rate decreased by 45.6% (from 10.9‰ to 5.5‰; $p<0.05$) over the eight years of observation.
5. As an objective indicator of the quality of medical care for newborns, the hospital mortality rate for newborns born sick and ill decreased from 1.0% to 0.6% during the study period and remained at this consistently low level for the next four years.
6. The assessment of the impact of the COVID-19 pandemic on newborn health revealed that there was a slight shift in the distribution of children born alive by birth weight and an increase in the stillbirth rate (+6.8% to the 2019 level).

Thus, in the period from 2013 to 2020, the share of children discharged from obstetric hospitals who were healthy increased due to the reduction in morbidity and mortality of newborns. The analysis showed that there was an improvement in the health indicators of newborns in the Russian Federation as a whole.

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