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ACCESS TO HEALTH CARE BEFORE BIRTH AND IN THE FIRST SIX YEARS OF A CHILD'S LIFE AS A RISK FACTOR FOR HEALTH AND DEVELOPMENT: COHORT MONITORING EXPERIENCE



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The presented work is a continuation of the research of a wide range of risk factors for the health of preschool children on the regional cohort monitoring materials. The aim of this stage is to study the impact of some factors concerning the organization of medical care on children's health and development in the intrauterine period from birth to six years of age. The article uses general scientific

(literature analysis, study and generalization of data, comparison, synthesis, induction, deduction, classification) and empirical (measurement, questionnaires, observation, comparison) research methods. The information base is sample data of prospective cohort monitoring in five waves: 1998, 2001, 2004, 2014, and 2020. The scientific novelty of the work consists in assessing the strength and directionality of factors associated with insufficient organization of medical care for pregnant women and young patients on specific adverse child health outcomes. We revealed that low provision of pregnant women with medicines increases the risk of child's underdevelopment at one year of age and weight deficit at 6 years of age, and lack of access to consultative medical care of narrow specialists increases the risk of putting the child on the dispensary register at 6 years of age. Difficulties in acquiring medicines in the first year of an infant's life increase the likelihood of stunted development, reduced health group at an early age, and deviations in body weight and physical development at age 6. Lack of access to consultations of narrow specialists at the age of 1, 3 and 6 years is associated with more frequent morbidity, impaired physical and neuropsychological development, risk of chronic diseases and placement on the dispensary register. Insufficient equipment of a medical facility and lack of financial resources of a family for paid assistance more than doubles the risk of dispensary observation of a child for a chronic disease. Therefore, the problems of staffing of women's clinics, perinatal centers and children's polyclinics, as well as the supply of pregnant women and children with free medicines and medical supplies, require special attention and early resolution to protect the child population's health.

Child health, risk factor, pregnancy, consultative medical care, availability of doctors, availability of medicines, child development, dispensary registration, weight deficit, health group.

Introduction

Medical care is currently considered as a public asset that all citizens can rely on, regardless of income and place of residence (Nikolyukina, Kondrashova, 2011; Starshinova, Gogoleva, 2015). In the modern world, the healthcare system not only provides high-quality and safe medical care, but also contributes to the growth of national well-being through disease prevention, restoring the health of patients and improving the quality of life (Morozova, Boskovich, 2024). A.S. Tulupov, Doctor of Sciences (Economics), professor at the Market Economy Institute of the Russian Academy of Sciences, suggests including indicators of the availability and accessibility of medical services, provision of medical institutions, availability of necessary medicines and equipment, and medically qualified personnel in the system for assessing

Russia's national security in the healthcare sector (Tulupov, 2024).

The maternity and childhood protection system is aimed at preserving and strengthening women's health, bearing and raising a healthy child. The availability and quality of medical measures provided to pregnant women at all gestation periods, women in labor, new mothers, and newborns living in urban, rural, and district areas of the region has a decisive impact on the index value of infant mortality (Tret'yakov et al., 2024). Pregnancy is the period of the greatest endurance test for the female body. The diagnosis of diseases in an expectant mother is difficult due to the unique physiology of her body, characterized by a deep restructuring of many organs and systems (Argunova, 2023). Women are often diagnosed with pathologies that did not manifest themselves before

gestation (Argunova, 2020). It is extremely important during this period to establish cooperation between the advisory services of specialized specialists and obstetricians and gynecologists in order to minimize the risk factors to the child's health from the mother.

In this regard, the World Health Organization (WHO) has declared access to a range of necessary medical services during pregnancy, childbirth and the postpartum period a fundamental right of women and children.

In a welfare state, one of the significant tasks to ensure the effective functioning of the healthcare system is to achieve a high level of quality and accessibility of medical care to the child population. In Federal Law 323-FZ, dated November 21, 2011 "On the fundamentals of public health protection in the Russian Federation"¹, the state recognizes the priority of protecting children's health as one of the most important and necessary conditions for their physical and mental development. Public authorities of the Russian Federation and its constituent entities, in accordance with their powers, are obliged to create and develop healthcare organizations that provide medical care to children.

A significant contribution to the development of a child's health is made at an early age, especially in the first months of life during adaptation to extrauterine life in the environment, when neuropsychological and physical development and functional maturation of body systems occur (Veltischev, 2000; Albitskii et al., 2007; Chicherin, Nikitin, 2010; Gadzhiev, Agalarova, 2016; Akhmedova,

2022). About 40% of children get sick before the age of three, while there is an increase in the incidence rate in the Russian Federation (Akhmedova, 2022). Therefore, one of the priorities of Russia's social policy since 2016 is to create a system for early detection of problems and comprehensive assistance in child development (Shmeleva et al., 2024).

Interagency cooperation and the availability of staff are important conditions for the effectiveness of early care. One of the May decrees of Russian President Vladimir Putin (Decree 204 "On national goals and strategic objectives for the period up to 2024", dated May 7, 2018²) defines the most important task of eliminating the shortage of personnel in healthcare and ensuring access to medical care. Without addressing this task, it is impossible to achieve success in any of the federal projects included in the national projects "Healthcare" and "Demography"³. It is emphasized that the main decisions regarding public health should be made at the primary level. These include, among other things, pregnancy support and the patronage of children in the first year of life.

We should note that the personnel crisis in healthcare is relevant for the entire global community. The density and distribution of health workers is an indicator of the UN Sustainable Development Goals⁴. Investments in the healthcare workforce contribute to economic growth⁵. According to (Haakenstad et al., 2022), globally, the provision of medical professionals steadily increased between 1990 and 2019. Nevertheless, there is a significant shortage of

¹ On the fundamentals of health protection of citizens in the Russian Federation: Federal Law of the Russian Federation 323-FZ, dated November 21, 2011. Available at: <https://minzdrav.gov.ru/documents/7025>

² On national goals and strategic objectives of development of the Russian Federation for the period until 2024: Presidential Decree 204, dated May 7, 2018. Available at: <http://www.kremlin.ru/acts/bank/43027>

³ National project "Healthcare" and ensuring accessibility and quality of primary healthcare services. Available at: <https://medvedomosti.media/pediatrics/articles/natsionalnyy-proekt-zdravookhranenie-i-obespechenie-dostupnosti-i-kachestva-pmsp>

⁴ UN Statistics Division Indicator 3.c.1. E-handbook on SDG indicators. Available at: <https://unstats.un.org/wiki/display/SDGeHandbook/Indicator+3.c.1>

⁵ WHO High-Level Commission on Health Employment and Economic Growth. Final report of the expert group. Available at: <https://apps.who.int/iris/handle/10665/250040>

healthcare workers worldwide compared to the estimated labor force levels. The shortage of national health personnel in 2019 amounted to 6.4 million doctors, 30.6 million nurses and midwives, 3.3 million dentists and 2.9 million pharmaceutical workers. WHO has outlined an ambitious agenda to expand and improve the quality of the healthcare workforce by 2030⁶.

Current problems in the development of healthcare personnel worldwide are related to staff shortages, an imbalance in the number of doctors and nursing and obstetric staff, an excessive concentration of qualified medical workers in large cities (Abzalieva et al., 2018) and their outflow from public medical organizations to private ones. We should note that due to the low level of salaries in the country in November 2022, there was a 25% shortage of medical personnel (Sobol', 2024). According to estimates by the Ministry of Health of the Russian Federation, in the fall of 2023, the shortage of mid-level specialists in public medical organizations amounted to about 50,000 people (Kuz'min et al., 2024). In turn, an insufficient number of medical specialists and poor quality of medical care contribute to the outflow of the population from small cities to regions with a more favorable standard of living and quality of life (Sobol', 2024).

Scientific research has proven that the number of population per district doctor cannot be 1,000–1,500 patients, even with an additional support provided by two medical professionals with secondary education (Raffoul et al., 2016). Otherwise, the quality of medical and preventive care is compromised. In the Russian Federation, the standard number

of the population receiving medical care at the general practitioner' office is 1,700 people aged 18 years and older in urban areas, 1,300 people in rural areas, and 800 children aged 0–17 for pediatricians⁷.

In modern literature, the issues related to the subjective assessment of the availability and quality of medical care by the population are presented quite widely and in various ways. The study of patient satisfaction with medical care through sociological research is one of the ways to assess its quality (Moiseeva et al., 2010; Sokolova, 2017; Kislitsyna, 2020; Buzin, 2022). The degree of patient satisfaction reflects not only the social effectiveness of medical organizations, but also the work of the entire healthcare system.

Thus, the problem with the availability of medical services is relevant, according to Superjob, for more than half of the Russians surveyed. About 60% rated the local healthcare system at three points or lower, and the quality of their services – two out of three respondents⁸. Staff shortage directly affects the problem of medical care accessibility. According to the comprehensive monitoring of the living conditions of the population conducted in 2022, more than 44% of those who applied for outpatient care to medical organizations and did not receive it pointed out the lack of the necessary specialist as the reason, and in rural areas their share exceeds 52%, and in cities with a population of 50 to 100 thousand inhabitants – 60%⁹.

As children grow up, they receive the bulk of medical care in a polyclinic. Parents, acting as legal representatives of the child, can objectively assess the quality of medical

⁶ WHO global strategy on human resources for health: Workforce 2030. Available at: <https://www.who.int/publications/i/item/9789241511131>

⁷ On approval of the regulations on the organization of primary medical and sanitary care for adults: Order of the Ministry of Health and Social Development of Russia 543n, dated May 15, 2012 (amended December 3, 2019); registered in the Ministry of Justice of Russia on June 27, 2012 No. 24726.

⁸ Evaluations of the quality and accessibility of medical care have increased over 4 years. Available at: <https://spb.superjob.ru/research/articles/114882/ocenki-kachestva-i-dostupnosti-mediciny-za-4-goda-vyrosli>

⁹ Comprehensive observation of living conditions of the population. Available at: https://rosstat.gov.ru/free_doc/new_site/GKS_KOUZH_2022/index.html

care provided on an outpatient basis, and, if necessary, protect the child's legitimate interests (Yur'ev, Sokolova, 2017).

According to a survey of parents, the main problems in the work of children's clinics are the insufficient level of qualification of specialists, their shortage, queues, insufficient attention to the child (Chvyreva, 2010; Polunina, Kudryashova, 2010; Denisov et al., 2015). The sample in the framework of these studies included parents of young children from various regions of the Russian Federation (city of Ryazan, Omsk Region) who expressed a desire to participate in the survey, mainly mothers aged 20–29 and 30–39. According to an anonymous survey of 1,488 parents of children receiving medical care in Saint Petersburg, conducted by employees of the St. Petersburg State Pediatric Medical University of the Ministry of Health of the Russian Federation (Yur'ev, Sokolova, 2017), the majority of parents find it difficult to make an appointment with a specialist in a children's polyclinic (78%), of which 40% – “sometimes”, 29% – “always”, and 8.5% consider it almost impossible. The following narrow specialists are the least accessible: pediatric otorhinolaryngologists (25% of parents), neurologists (18%), orthopedists (14%), allergologists (13%), cardiologists (12%) and ophthalmologists (10%). More than half of respondents (53%) noted difficulties in obtaining appointment cards for instrumental types of research (ultrasound, X-ray, ECG, CT, MRI, etc.).

Based on statistical materials from Rosstat, the Ministry of Health of the Russian Federation and the database of the Central Research Institute of the Ministry of Health of the Russian Federation as a whole for the Russian Federation, constituent entities of the Russian Federation and its federal districts, a comparative analysis was used to study the dynamics of changes in the network of medical organizations in rural areas, indicators of availability of medical personnel, provision of beds for the period from 2003 to 2018. It has been revealed that due to the reduction

in the number of rural residents, problems arise in the organization of therapeutic, preventive and consultative diagnostic care (Rugol' et al., 2020). Indeed, the results of an anonymous survey of 100 parents of patients of the children's polyclinic department of Novodevyatkinsky rural settlement indicate that the problem of access to medical care is particularly acute for the child population. Almost 60% of the parents who participated in the survey sought medical help from other medical organizations: they paid for specialist advice, ultrasound, ECG, radiography, and MRI. The main reasons for applying to private medical organizations and using paid services are the lack of queues, location within walking distance, convenient work hours, and the availability of highly qualified doctors (Sobolev et al., 2018).

There are some foreign studies confirming that a decrease in satisfaction with the work of primary care physicians is associated with a decrease in the quality and continuity of treatment (Bodenheimer, Sinsky, 2014; Willard-Grace et al., 2019). Staff shortage, current policies and the organization of healthcare create a shortage of time allocated for a patient during the appointment. At the same time, scientists admit that very few in-depth studies have been conducted examining the harm to the patient's health that a shortened doctor's appointment time can cause, impairing the quality and safety of treatment (Satterwhite et al., 2024).

The cohort monitoring method, which uses statistical, medical, and sociological observation (Grzhibovskii, Ivanov, 2015), has proven effective in terms of health, and is systematically used to study the causes and prevention of childhood diseases (Nauen, 2006; Grzhibovskii, Ivanov, 2015; Fleischer, Albright, 2024).

Previously, we calculated the relative risk of a number of biomedical, socio-demographic, environmental, and socio-economic factors formed before the birth of a child, affecting its health during the intrauterine period

and during the first seven years of life; to this end we used the data of five waves of prospective monitoring of cohorts of families with children conducted by Vologda Research Center of the Russian Academy of Sciences as part of the research project “Studying the conditions for the formation of a healthy generation” since 1995¹⁰ (Shmatova et al., 2022; Shmatova et al., 2023a; Shmatova et al., 2023b; Shmatova, Razvarina, 2023). However, there remains an urgent question of how the shortage of personnel in healthcare, the low availability of free, state-guaranteed medical care to a woman during pregnancy can affect the child’s health during the formation of the work of all organs and systems. In this study, we will take a closer look at the impact of these two factors.

The aim of the study is to evaluate the impact of certain factors of the organization of medical care on the health and development of children in the prenatal period and from birth to six years of age.

Research objectives are as follows: to assess the main statistical and sociological markers of the health of expectant mothers and the child population; to analyze statistical and sociological data characterizing the activities of the healthcare system and the degree of accessibility of its services and specialists; to calculate the relative risk of adverse factors of access to medical care for the health and development of the child before birth and in the first six years of life.

The object of the study is families with children in the Vologda Region; the subject is the health of children aged 0–6.

Research methodology

At the first stage of the study, Rosstat data were analyzed, characterizing some negative trends in the health status of women, pregnant women and new mothers, as well as children under 14 and adolescents aged 15–17 for the period from 2010 to 2022. Additionally, statistical data on government budget expenditures in different countries and regions of Russia on the healthcare system were studied, and indicators of the availability of medical personnel and beds were considered.

At the second stage of the study, an assessment was made of sample data from the above-mentioned medical and social cohort monitoring “Studying the conditions for the formation of a healthy generation”. The informants filling out the questionnaires were medical professionals (obstetrician-gynecologist, neonatologist, pediatrician) and mothers of children. Inter- and intra-cohort data analysis methods were used.

The information base combines data from cohort medical and social monitoring of five rounds: 1998, 2001, 2004, 2014, 2020. The initial number of new mothers was 1,464 women; 1,037 children were examined, who took further part in the study at the age of 0–6.

The assessment of the strength of the factor’s relationship with individual parameters of the child’s health status was carried out by calculating the relative risk

¹⁰ Each cohort (born in 1998, 2001, 2004, 2014, 2020) was selected in five settlements of the Vologda Region: in the cities of Vologda, Cherepovets, Veliky Ustyug, Kirillov and the rural settlement of Vozhega. The selection of settlements was carried out in a random order. The criteria for inclusion in each cohort were childbirth in a certain period of time (March – April) and the woman’s consent to participate in the survey. A total of 1,464 children were selected in the five cohorts. Of these, 1,037 participated in at least one stage of the study before the child reached the age of 7. These are the ones who made up the sample of the present study. Data on the first cohort, selected in 1995, were excluded from the analysis due to the low informativeness of the first questionnaire regarding child health risk factors. Our own monitoring methodology involved the completion of questionnaires by different groups of respondents: children (from the age of 10), parents (mainly mothers) and health workers. Questions about the state of neuropsychiatric and physical development and living conditions were included for the children in this sample. The questionnaire consisted of two parts, one of which (regarding living conditions and children’s development) was filled in by parents, and the other, containing an assessment of child health, was filled in by neonatologists and district pediatricians.

index (RR). RR was calculated as the ratio of the occurrence of an adverse health outcome in the “exposed” group (exposed to a risk factor) to a similar risk in the “unexposed group” (not exposed to a risk factor) based on a four-field contingency table: risk factor (yes/no) × unfavorable outcome (yes/no).

$$RR = \frac{A \cdot (C + D)}{C \cdot (A + B)}$$

	There is an adverse health outcome (1)	There is no adverse health outcome (0)	Total
Risk factor is present (1)	A	B	A + B
Risk factor is absent (0)	C	D	C + D
Total	A + C	B + D	A + B + C + D

If RR is greater than 1, then the effect of the factor under consideration increases the risk of developing an adverse outcome, and the higher the RR value, the higher the probability. If RR is less than 1, then the factor is protective and reduces the likelihood of loss of the health indicator. In each case, the statistical significance of the relative risk must be assessed based on the values of the 95% confidence interval (CI). We should note that RR does not contain information about the magnitude of the absolute risk, but demonstrates the strength of the link between the influencing factor and the lag in development.

We analyzed the impact of the risk factor on children’s health during the woman’s pregnancy (the mother’s retrospective responses to the questionnaire) and upon receiving medical care for the child at the age of 6 months, one year, three and six years.

Let us focus on the (1) risk factors and (2) adverse health outcomes that we need to

calculate the relative risk index and form a four-field contingency table.

Within the framework of this study, as a medical care accessibility factor, we evaluated the responses of women participating in the monitoring on satisfaction with the following aspects of the organization of medical support during pregnancy: (1) possibility of receiving timely laboratory diagnostic examination; (2) availability of timely qualified obstetric and gynecological (medical), (3) availability of therapeutic care, (4) availability of medical advice from narrow specialists (neurologist, ophthalmologist, etc.); (5) possibility of timely hospitalization; (6) availability of necessary medicines (including preparations containing iron and vitamins) and medical supplies; (7) availability of information on prenatal care and (8) availability of information on newborn care. We considered the factor to be positive in the case of a negative assessment, dissatisfaction of the future mother with these indicators of medical support.

Later, after the birth of the child, as a risk factor considered in this study, we investigated (1) the mother’s “low” assessment of the availability of types of medical care for the child (timely laboratory and diagnostic examination; timely qualified assistance from a pediatrician; doctors of various specialties (neurologist, surgeon, allergist, etc.); timely hospitalization if necessary; medicines (including vitamins) and medical supplies; information on child care in cases of illness; (2) “frequent” problems in the organization of the work of children’s medical institutions (queues and inability to get an appointment with specialists; poor organization of the registries; incompetence of the doctor; inconvenient schedule of specialists; inattentive, disrespectful attitude of health workers; lack of necessary specialists and lack of information about their work; the

need to use paid services; lack of money for paid specialists; lack of medical equipment in medical facilities; lack or high cost of medicines).

As unfavorable outcomes for a child's health, we considered the following: (a) frequency of morbidity (the frequency of more than 5 times a year was taken into account); (b) correspondence of physical (developmental delay, as well as excess/lack of body weight) and neuropsychiatric development (NPD) to the age norm (lag); (c) health group (group 2 or lower health groups); (d) enrollment of the child into a regular medical check-up.

The initial information was processed and analyzed using Microsoft Office Excel and IBM SPSS Statistics software (ver.22.0). In the discussion of the results, we present only those risk factors that have demonstrated a link with the deterioration of the child's health.

The scientific novelty of the presented work lies in clarifying and detailing the strength and direction of the impact of the factor associated with the flaws in the organization of medical care for a pregnant woman and a young child on specific adverse health outcomes of the child.

The practical significance of the conducted research will allow us to scientifically substantiate the urgent need to solve the problem of human resources in healthcare as soon as possible when planning future strategies for the prevention of health disorders, physical and neuropsychiatric development of children, starting with the work of antenatal clinics, perinatal centers, children's and adult polyclinics.

Results and discussion

Main trends in the health status of pregnant women and children in Russia

It has been scientifically proven that the health of an expectant mother is a protective factor in the development of her child. Statistical data on women's health before and during

pregnancy and childbirth demonstrate favorable progressive trends in reducing morbidity and improving most indicators. However, we will focus on some negative trends in the health of the female population. According to Rosstat, a 20% increase in the incidence of malignant neoplasms in women can be noted in the period from 2010 to 2022 (*Tab. 1*), especially malignant neoplasms of the breast (by a third) and uterus (by a quarter), which may be caused to a greater extent by improving the system of early diagnosis of these pathologies. The infertility rate of Russian women of childbearing age was increasing until 2015, followed by a decrease; in 2021–2022 it remained approximately at the same level (203 women per 100,000 women aged 15–49). A progressive increase is also noted in the indicator of menstrual disorders in women of reproductive age.

Some pathologies in pregnant women can have a significant harmful effect on the course of labor. Thus, during the period under consideration, the incidence of diabetes mellitus in expectant mothers, which complicated childbirth, increased by more than 30-fold (see *Tab. 1*). The proportion of various venous disorders increased slightly. The number of cases of anemia in pregnant women increased during 2010–2019, followed by a decrease in the indicator. Nevertheless, its value is 8% higher than in 2010. The frequency of bleeding in the placental and postpartum stages of labor has increased by a quarter since 2019 and is also higher than in 2010.

However, we should note the favorable trends in reducing the incidence of diseases of the genitourinary and cardiovascular systems in pregnant women (by 30%), labor disorders (by 40%) and cases of hypertensive disorders, edema (by more than half).

Approximately 35–37 out of 100 births are considered normal, and their proportion is stable throughout the period in question (2010–2022). However, there is a growing trend in the use of surgical delivery (by 40%; see *Tab. 1*) and vacuum extraction (2.6 times). According to our

Table 1. Negative dynamics of indicators of women's health status and complications in childbirth in Russia in 2010–2022

Indicator	Year						Dynamics
	2010	2015	2019	2020	2021	2022	
Incidence of certain diseases in women, per 100,000 women							
Malignant neoplasms, including:	363.06	405.03	440.46	379.29	400.34	435.35	119.9
breast	74.5	84.5	93.3	82.1	88.5	97.5	130.9
cervix and uterine body, placenta	45.1	52.3	56.5	50.2	52	56	124.2
ovary	17.0	17.8	17.9	16.6	16.9	17.9	105.3
Menstrual disorders*	1390.3	1360.4	1456.8	1302.9	1439.1	1505.3	108.3
Infertility*	201.28	278.33	252.39	192.52	204.06	203.29	101.0
Number of diseases complicating childbirth per 1,000 births							
Diabetes mellitus	3.7	23.7	76.2	86.2	101.8	113.9	3078.4
Venous complications	22.1	19.8	23.6	24.3	26.3	25.2	114.0
Anemia	230.8	235.3	263.3	261.7	258.1	248.9	107.8
Postpartum and postpartum hemorrhage	12.7	10.8	10.6	11.2	11.7	13.4	105.5
Obstetric operations performed, per 100 births							
Vacuum extraction	0.5	1.0	1.2	1.3	1.3	1.3	260.0
Caesarean section	22.3	27.6	30.1	30.3	30.9	31.2	139.9
Normal delivery, %	37.4	38.4	36.0	35.9	35.3	36.2	96.8

* Per 100 thousand women aged 15–49.
Source: Healthcare in Russia – 2023. Section 2. Health status of the population. 2.3. Health status of women. Available at: https://rosstat.gov.ru/storage/mediabank/zdravooxran_2023.htm

earlier research, the latter is a serious risk factor for the health of an unborn child, increasing the likelihood of being enrolled into a regular medical check-up throughout infancy, early childhood and preschool (Shmatova et al., 2022).

The sociological data on the health status of the mothers who participated in the cohort monitoring generally confirm the statistical information. During 1998–2020, pregnant women's self-reported health improved: they were five times more likely to consider it "excellent" (21% in 2020). Since 1998, the incidence of gynecological diseases has decreased by 80%, diseases of the genitourinary system – by 70%, digestive and circulatory systems – by 60%, skin – by a third, respiratory organs and endocrine system – by a quarter. The negative trend is an increase in diseases of the nervous system and sensory organs (by a quarter).

However, according to the obstetric history data, we have previously noted the following negative trends (Shmatova, Razvarina, 2023): during pregnancy, women began to develop diseases of the endocrine system more often (22% in 2020), diabetes mellitus (13.5%), thyroid diseases (7%), hypertension (5%). We should note that the spread of thyroid pathologies is a global trend. The diseases identified in an expectant mother create serious diagnostic and therapeutic problems (Papaleontiou, Haymart, 2022) and can lead to intrauterine neuropsychiatric disorders, low birth weight, and even fetal death (Udovica, Stepura, 2015).

There is also an increase in 2020 in the frequency of toxicosis in the first half of pregnancy (twice as compared with previous cohorts) and diseases of the genitourinary system in expectant mothers (by 40% since

2004). The positive aspects in 2020 were the minimum prevalence rate of anemia in pregnant women during all monitoring years (40%), as well as the tendency toward reducing toxicosis in the second half of pregnancy (from 18% in 1998 to 3% in 2020).

According to the results of the cohort monitoring, obstetricians and gynecologists were 2.4 times more likely to use cesarean section (from 8% in 1995 to 28% in 2020) during delivery, which also corresponds to statistical data. Less often, certain complications during childbirth are observed (bleeding, early discharge of amniotic fluid, prolonged and rapid labor), which, of course, is a protective factor for the health of the newborn.

The deterioration of a number of indicators of women's health and labor entails a negative trend in the health status of the child population (Tab. 2). According to Rosstat, approximately one in three (31.5% in 2022, or 398 thousand newborns) of those born alive is unhealthy. Compared to 2010, the indicator improved by 3 percentage points, mainly due to a reduction

in the proportion of the diagnosis of "certain conditions that occur in the perinatal period" (in 2010, every second patient was a newborn, and in 2022 – 43%, or 545,300 children). However, the proportion of newborns with congenital malformations increased by 20%, amounting to 3.6% (45,900 newborns).

Approximately one in five (200 per 1,000 children) children in the first year of life suffers from some kind of nervous system disease (see Tab. 2), and almost one in ten in 2022 had congenital malformations, deformities and chromosomal abnormalities. Both indicators are higher than in 2010 by 7% and 28%, respectively. The proportion of children affected by various injuries, poisoning and some other external influences in the first year of life increased by more than 43%.

The growing number of congenital malformations detected both at birth and in the first year of an infant's life is a very worrying trend.

Compared with 2001, the assessment of the health status of newborn cohort monitoring participants using the Apgar score is growing

Table 2. Children's health indicators in Russia in 2010–2022

Indicator	Year					
	2010	2015	2019	2020	2021	2022
Health status of newborns, % of live births						
Children born sick or diseased (body weight 1,000 g and more), including:	35.5	31.8	31.4	30.9	31.1	31.5
congenital anomalies	3.0	2.9	3.4	3.3	3.4	3.6
Certain conditions arising in the perinatal period	49.3	43.4	43.0	42.0	42.7	43.1
Premature	5.3	5.8	6.2	6.0	6.2	6.0
Morbidity rate in children in the first year of life, per 1,000 children under one year of age						
Diseases of the nervous system	195.5	204.2	214.7	205.9	216.1	209.4
Congenital anomalies, deformities and chromosomal disorders	74.0	67.7	86.5	83.7	90.8	94.8
Trauma, poisoning and other external causes	16.1	13.0	23.3	22.8	22.7	23.1
Incidence of mental and behavioral disorders in children aged 0–14, per 100,000 children aged 0–14						
Psychoses and mental deficiency	8.8	12.5	15.5	15.2	19.4	22.4
Number of patients enrolled into regular medical check-up with a diagnosis of psychosis and mental deficiency, per 100,000 children aged 0–14						
Psychoses and mental deficiency	74.8	91.2	136.0	149.8	166.9	190.8

Source: Healthcare in Russia – 2023. Section 2. State of public health. 2.3. Health status of children aged 0–14. Available at: https://rosstat.gov.ru/storage/mediabank/Zdravooxran_2023.htm

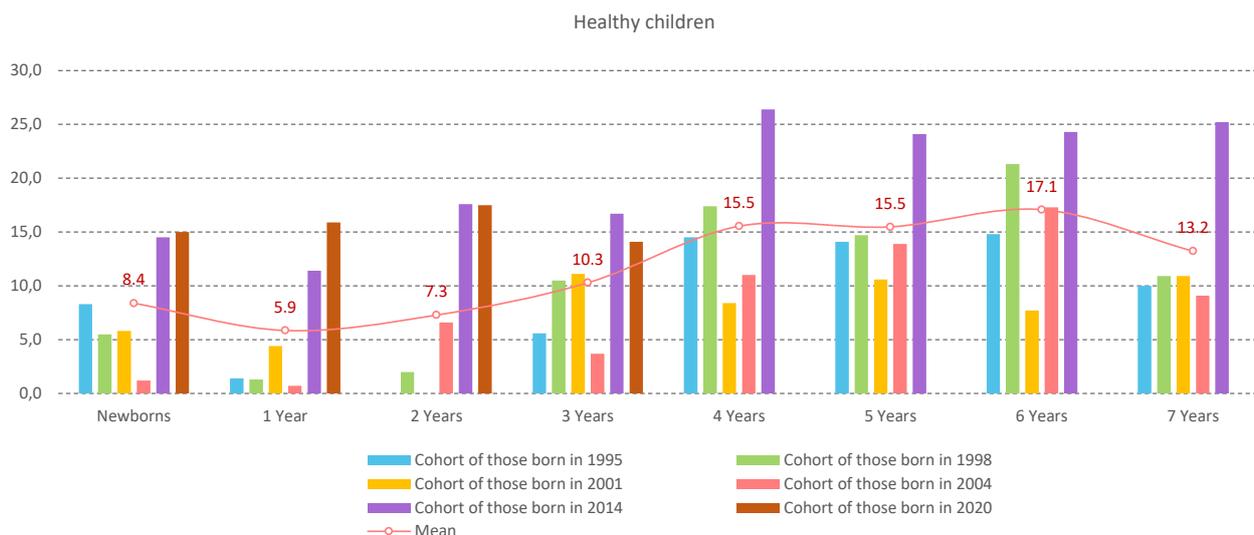


Figure 1. Proportion of healthy children participating in six cohort monitoring rounds during the preschool period, %

Source: own research findings.

(from 8.0 points in 2001 to 9.1 in 2020). Serious congenital malformations and diseases are also twice as rare (29.6% in 2001 and 16.6% in 2020). We should note that the peculiarity of the monitoring sample is the voluntary participation of new mothers; thus, it did not cover all of them. We believe that mothers who gave birth to children with serious developmental pathologies initially refused to participate in the survey, so the sociological data somewhat do not correspond to the statistical indicators of the spread of congenital pathologies in newborns, which does not detract from the significance of the results obtained.

According to Rosstat¹¹, the proportion of healthy children who, according to regular medical check-ups, belong to health group I is stable throughout 2015–2022. (within 28–29%). The share of representatives of health group II is more than half of children (56–57%), health group III – 12–14%, the rest – 2–3%.

However, the analysis of the results of the cohort monitoring does not allow us to speak about such a large number of representatives of health group I. In 2004, the minimum number

of healthy children was registered (about 1% of newborns; Fig. 1). The largest proportion of children of health group I throughout the preschool period was observed in the cohort born in 2014. After the age of four, every fourth child had health group I.

According to Figure 1, the largest decrease in the proportion of healthy children is observed in the first year of life (5.9% on average for 6 cohorts), and later there is a slight increase in their number up to 6 years of age (up to 17%), followed by a decrease by the time they enter school (up to 13%).

Main markers of the activity of the healthcare system and the degree of accessibility of its services and specialists

The undisputed leaders in spending on the healthcare system, according to Rosstat¹², are the United States, Germany, the United Kingdom, and Sweden, which allocate about 10% of GDP to this area. They are followed by France (9.4%), Denmark (9.3%), Austria and Belgium (8.8%), Canada (8.7%), Norway (8.6%), Czech Republic (8.1%). The Asian region is led by Japan (9.2% of GDP), Israel (5.9%), and the Republic of Korea (5.1%). In 2021, Russia spent

¹¹ Healthcare in Russia – 2023 (2023): Statistics collection. Moscow: Rosstat. 181 p. Section 2.43. Results of medical check-ups of children aged 0–14.

¹² Russia and countries of the world – 2023. Section 7. Healthcare. 7.5. Public expenditures on healthcare. Available at: https://rosstat.gov.ru/storage/mediabank/Rus_stran_mira_2023.htm

3.8% of its GDP on healthcare, which is less than in South Africa (5.3%), a number of Latin American countries, as well as in the former Soviet republics: Belarus, Moldova and Latvia.

Nevertheless, the level of provision of medical workers in Russia can be compared with that of advanced European countries, which is recognized by foreign scientists (Haakenstad et al., 2022). The number of doctors in Russia is quite high, in 2021 it amounted to 505 (in 2022 – 508) per 100 thousand people, which allows the country to occupy the sixth place in Europe according to this indicator. The top five in 2021 included Greece (616), Austria (541), Portugal (532), Belarus (522) and Norway (516). In Asia, the largest number of doctors are in Israel (335), Azerbaijan (324), Uzbekistan (271), Japan (260) and South Korea (256). The lowest rates were observed in Europe – in France and the UK, in Asia – in Bangladesh (67) and India (70). There were 267 doctors per 100,000 Americans and 277 doctors per 100,000 Canadians in 2021¹³.

In terms of the number of hospital beds, Russia ranked second in Europe in 2021 (791 beds per 100,000 people, and 780 in 2022) after Bulgaria (792). High rates were also observed in such European countries as Germany, Romania, Austria, Moldova, and the countries of the Asian region – the Republic of Korea, Japan, and China. There are fewer beds, as well as doctors, in Asia – in India and Bangladesh, in Europe – in Sweden, the United Kingdom, Denmark. In the United States, the number of hospital beds per 100,000 people (277) is less than in Israel (291) and 2.8 times lower than in Russia¹⁴.

The Northwestern Federal District has the highest number of medical specialists in Russia (63.2 per 10,000 people; *Tab. 3*), mainly due to Saint Petersburg with an indicator of 89 doctors per 10,000 people). At the same time, the district

includes three outsider regions in terms of healthcare staffing: the Pskov (35.0), Leningrad (35.8) and Vologda (36.0) regions. The latter ranks 81st in the country, which indicates the urgency of the problem of personnel shortage for the region.

In Russia, according to Rosstat¹⁵, in 2023 there were 744 thousand doctors, in the Vologda Region – just over 4 thousand. At the same time, the share of employees in state-owned medical institutions is decreasing, while in private clinics it is significantly increasing (in Russia since 2016 – by 71%, in the Vologda Region – by 56%).

The rate of staffing of full-time positions in the country as a whole has increased to 63.6% over the past five years, while the ratio of part-time workers has decreased to 1.3 (Latyshova, Ivanova, 2023).

Analyzing the data from Rosstat¹⁶, we can say that in 2010–2023, the provision of pediatricians in Russia has significantly decreased (by a third per 10,000 children aged 0–14), phthisiologists (by 16%), psychiatrists and narcologists (by 12%), but the number of radiologists has increased (by 30%), as well as the number of ophthalmologists and surgeons (by 16%), dentists (by 14%), general practitioners (by 13%) and otolaryngologists (by 11%).

In general, according to the participants of the cohort monitoring, the severity of most of the problems in question related to the organization of medical supervision of expectant mothers has decreased over 1998–2014 (*Fig. 2*). There is a particular increase in the average assessment in the cohort born in 2014, with the exception of one aspect – “availability of necessary medicines and medical supplies” (the indicator remained at the level of 7.3 points, which is even lower than the level of 7.6 points in 2001).

In 2020, the greatest number of positive assessments accounted for the possibility of

¹³ Russia and countries of the world – 2023. Section 7. Healthcare. 7.1. Some indicators of healthcare system development. Available at: https://rosstat.gov.ru/storage/mediabank/Rus_stran_mira_2023.htm

¹⁴ Ibidem.

¹⁵ Number of doctors of all specialties (individuals) in organizations providing medical services to the population at the end of the reporting year. Available at: <https://fedstat.ru/indicator/31547>

¹⁶ Healthcare in Russia. 2023. Available at: https://rosstat.gov.ru/storage/mediabank/Zdravooxran_2023.htm

Table 3. Number of doctors of all specialties, per 10,000 people, people

Region	Year						Rank in the RF, 2022
	2005	2010	2015	2020	2021	2022	
Russian Federation	48.6	50.1	45.7	50.0	50.5	50.8	-
Central FD	50.9	53.5	45.5	52.1	53.2	54.0	3
Southern FD	43.6	44.4	41.5	43.9	44.0	44.3	7
North Caucasus FD	42.5	40.1	39.2	43.4	43.3	43.7	8
Volga FD	46.7	47.2	45.0	47.5	47.6	47.5	6
Ural FD	42.5	46.0	43.1	47.1	47.4	48.2	5
Siberian FD	51.6	52.4	47.2	49.5	49.8	49.5	4
Far Eastern FD	52.3	54.2	51.8	54.7	54.5	54.4	2
Northwestern FD	54.3	57.8	54.5	61.6	62.8	63.2	1
Republic of Karelia	50.5	50.4	51.2	59.5	60.6	59.0	13
Republic of Komi	45.0	47.5	50.3	55.3	54.8	54.0	24
Arkhangelsk Region, including: Nenets Autonomous Area	53.2	56.6	55.4	59.6	60.8	61.1	-
Arkhangelsk Region without AA	39.1	44.4	48.0	54.6	57.2	55.6	18
Vologda Region	35.3	34.6	35.2	36.2	35.7	36.0	81
Kaliningrad Region	53.7	57.0	55.7	59.8	61.0	61.3	8
Leningrad Region	35.7	34.5	44.5	46.4	48.3	49.5	35
Leningrad Region	30.6	34.4	32.8	35.5	36.3	35.8	80
Murmansk Region	50.1	57.4	55.4	55.2	55.5	55.0	21
Novgorod Region	39.2	41.3	43.2	42.8	43.5	43.1	64
Pskov Region	34.7	34.6	34.5	33.2	34.5	35.0	83
Saint Petersburg	80.0	84.8	72.3	86.0	87.9	89.1	1

Source: Regions of Russia. Socio-economic indicators – 2023 (2023): Statistics Collection Section 6. Healthcare. 6.4. Number of doctors of all specialties. Rosstat. Moscow. Pp. 372–373. Available at: https://rosstat.gov.ru/storage/mediabank/Reg_Rus_Pokaz_2023.htm

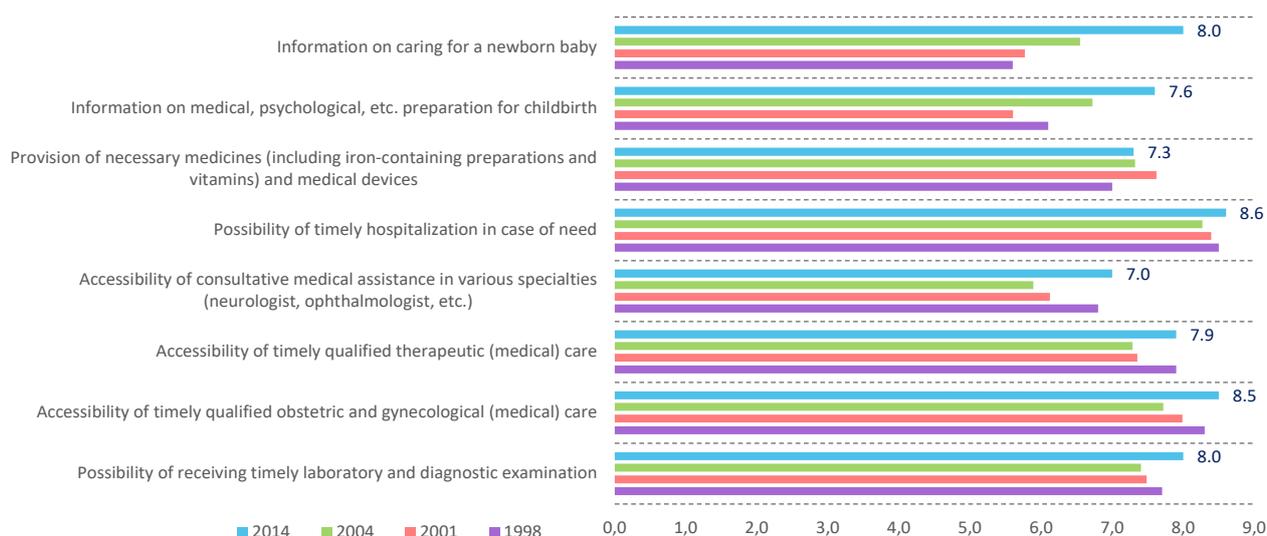


Figure 2. Distribution of responses to the question “Please rate on a scale from 1 (low) to 10 (high) the degree of accessibility of the following circumstances related to the organization of medical supervision during the present pregnancy”

Source: own research findings.

timely hospitalization if necessary. More than 60% of new mothers highly appreciated this area of work of health services. Almost the same number are convinced of the high availability of qualified obstetric and gynecological care. Slightly less (every second participant in the cohort monitoring) are completely satisfied with the possibilities of laboratory diagnostic examination. Less than 4% of the respondents gave a low rating to the above-mentioned aspects of the organization of medical supervision during pregnancy.

Nevertheless, the most acute problems of organizing medical care for expectant mothers, according to the participants of the cohort

monitoring, are the unavailability of medical advice from specialized specialists: neurologist, ophthalmologist, etc. (in 2020 – one in five) and insufficient availability of necessary medicines (including those containing iron, vitamins) and medical supplies (in 2020 year – every fourth; Fig. 3).

The highest estimates of the availability of doctors in various specialties and medicines during pregnancy monitoring were given by expectant mothers from Cherepovets, while low estimates were given by residents of Vologda and rural areas (Tab. 4). Staff shortage, judging by the respondents' estimates, is slightly less relevant for Cherepovets. In general, the assessment of all indicators is much higher among Cherepovets

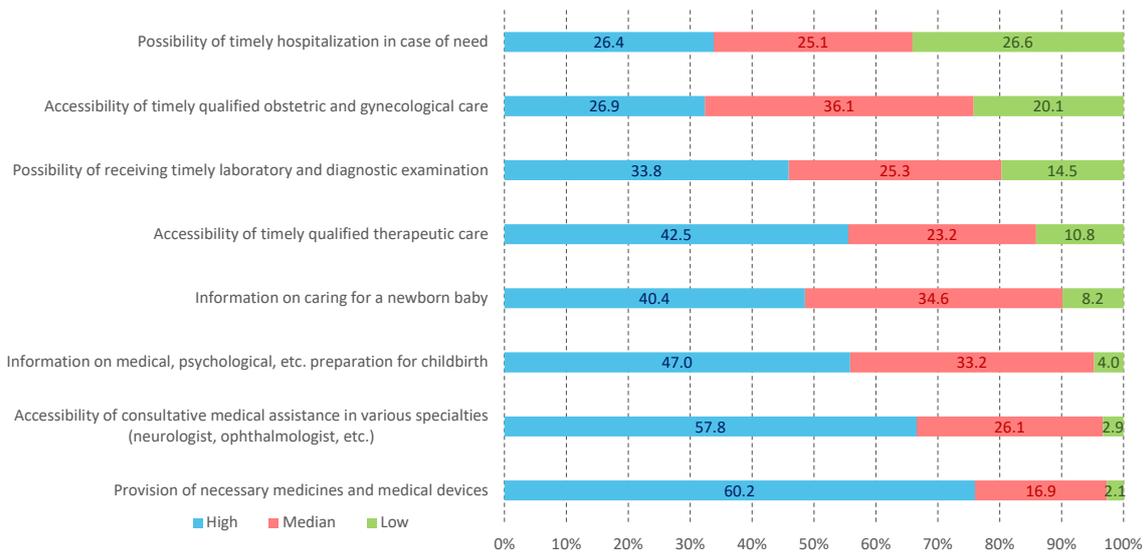


Figure 3. Assessment of accessibility in various aspects in the organization of medical supervision during pregnancy, 2020, % of respondents

Source: own research findings.

Table 4. Assessment of the availability of necessary medicines, medical supplies and doctors during pregnancy, 2020, %

Assessment	Mean	Territory			Health groups	
		Vologda	Cherepovets	Districts	I	II ... IV
Provision of necessary medicines (including iron and vitamins) and medical devices						
High	26.4	25	31.3	20	21.5	28.7
Median	25.1	25.4	20.9	35	24	25.6
Low	26.6	27.2	25.2	27.5	28.1	26
Availability of consultative medical assistance in various specialties (neurologist, ophthalmologist, etc.)						
High	26.9	22.8	35.7	25	21.5	29.5
Median	36.1	37.9	32.2	37.5	36.4	36
Low	20.1	21.4	17.4	20	23.1	18.6

women, which may indicate a truly more well-established and developed system of medical support for expectant mothers.

It is noteworthy that mothers who have given birth to children with health group II and higher are more likely than mothers of children with health group I to be satisfied with the organization and quality of care provided to them during pregnancy.

Despite Russia's good position in the world in terms of provision of doctors and medical beds per capita, the problem of staff shortage in healthcare (including in the Vologda Region) remains extremely relevant, especially in government institutions, rural areas and a number of remote, economically disadvantaged regions or territories adjacent to large developed centers. There is an urgent need to solve the problem of the shortage of qualified medical personnel. The Vologda Region is taking certain steps in this direction, including through the opening of a branch of the Yaroslavl Medical Institute, the introduction of support programs for young professionals, including in rural areas (for example, "Zemsky Doctor"), and an increase in salaries for doctors and nursing staff.

Impact of the organization of the healthcare system and its accessibility on the health of cohort monitoring participants

By calculating the relative risk indicator, we revealed that mothers' negative assessments of the organization of medical care, starting from the prenatal period of the child's development, are most closely related to the parameters of its health as the child grows up.

So, if the expectant mother did not receive sufficient medical advice from a neurologist, ophthalmologist and other specialized specialists during pregnancy, then at the age of 6 the child was more often enrolled into a regular medical check-up (RR = 2.25; 95% CI:1.15–4.39).

On the one hand, the future mother's need for qualified medical help from individual doctors

could be related to her having chronic diseases and initially having a low potential for her own health. This could lead to the development of similar problems in her child. On the other hand, failure to provide timely advice to a pregnant woman and unapproved treatment could lead to fetal development disorders that were not diagnosed after birth, but manifested themselves only by pre-school age.

The low provision of medicines (including those containing iron and vitamins) and medical supplies to the expectant mother increases the risk of a decrease in the child's health group by the age of six months (RR = 1.56; 95% CI: 1.03–2.43) and years (RR = 1.91; 95% CI: 1.22–3.01), lagging in physical and mental development. neuropsychiatric development in the first year of life (RR = 2.04; 95% CI:1.22–3.41), weight deficiency by pre-school age (RR = 4.56; 95% CI:1.94–10.73). Thus, a pregnant woman does not have the opportunity to receive the necessary medical treatment for her diseases (including anemia, which is very dangerous for fetal development), can negatively affect the formation and development of various organs and systems of the unborn child, and lead to a deterioration in its health indicators during the first six years of life.

If the mother of a six-month-old baby faced difficulties in purchasing medicines and medical supplies, this also increased the likelihood of a child's developmental delay in the first year of life (RR = 2.21; 95% CI: 1.11–4.40) and a decrease in the health group at the age of one year (RR = 2.60; 95% CI: 1.64–4.12) and three years (RR = 2.25; 95% CI:1.33–3.82), BMI abnormalities (HR = 3.30; 95% CI:1.89–5.78) and physical development at 6 years (RR = 4.95; 95% CI:2.03–12.06). Difficulties in obtaining consultations from specialized specialists at the age of six months in a child were associated with frequent morbidity at 6 years of age (RR = 5.88; 95% CI: 1.10–31.45), and at one year of age – with physical disabilities (RR = 4.73; 95% CI: 2.03–11.04)

and enrollment into a regular medical check-up at 6 years of age (RR = 2.70; 95% CI:1.41–5.17).

Lack of access to narrow specialists after the child reaches the age of three is also associated with a lag in physical and neuropsychiatric development (RR = 2.01; 95% CI:1.09–3.70), at 6 years of age – with the risk of chronic diseases requiring medical examination (RR = 2.46; 95% CI: 1.08–5.60). Low availability of medical care for a child at 3 years of age also positively correlates with deterioration of health parameters in pre-school age: enrollment into a regular medical check-up (RR = 2.09; 95% CI: 1.05–4.14), health group below II (RR = 1.31; 95% CI: 1.07–1.60), lag in physical development (RR = 4.56; 95% CI:1.92–10.85) and weight deficiency (RR = 3.14; 95% CI:1.28–7.71).

A similar situation is observed with risk factors related to the organization of medical care before entering school. The probability of developing pathologies requiring enrollment into a regular medical check-up increases significantly if the mother complains about the lack of the necessary specialists (RR = 4.08; 95% CI: 2.35–7.11) and the possibility of consulting with them (RR = 3.80; 95% CI: 1.66–8.67), insufficient provision of the necessary equipment at a medical institution (RR = 2.23; 95% CI:1.11–4.51) and a shortage of funds for visits to paid specialists (RR = 2.37; 95% CI:1.28–4.40).

As you can see, problems with the timely appointment and treatment of a child in the first year of life, as well as in early childhood and pre-school age, can provoke the development and aggravation of chronic diseases and the enrollment of the child into a regular medical check-up, developmental disabilities, more frequent morbidity and further loss of health. We assume that further study of the negative impact of the factor of accessibility of medical care (more precisely, its inaccessibility) to a pregnant woman and her child in infancy

and early development will demonstrate its prolonged effect in the primary school and adolescent periods of development, which means it will affect the health potential of an adult, which they will eventually pass on to future generations.

We understand that there is a wide range of possible intersection and mutual influence of risk factors for a child's health in different periods of development, which requires further in-depth and comprehensive study and will become one of the promising areas of our research.

Conclusion

The study has shown that, despite some positive changes in the health indicators of the female and child populations, there are a number of alarming trends that require a well-established system of timely and qualified assistance to these vulnerable groups. Namely: the incidence of cancer in women, especially breast and uterine cancer, and menstrual disorders is increasing; pregnant women have diabetes, venous complications, and anemia; the number of cases of using a vacuum extractor and cesarean section during childbirth is increasing, as well as the frequency of bleeding during this period; approximately one in three children born is unwell; the proportion of congenital malformations and chromosomal abnormalities is increasing; the incidence of diseases of the nervous system is increasing in children under 14 years of age, more injuries and poisoning, psychoses and mental deficiency are recorded.

An analysis of individual indicators of the healthcare system in Russia has demonstrated their comparability with a number of global trends. However, it is necessary to increase the expenditure item of the state budget for medicine. The availability of qualified medical personnel in Russia is quite high compared to most countries in the world, but there are significant regional differences associated with the concentration of doctors mainly in

metropolitan and economically developed regions and their severe shortage in the rest of the country. The Vologda Region is among the outsiders in terms of medical personnel availability. The problem of the outflow of specialists to the private sector of the economy is also extremely urgent. In addition, the proportion of pediatricians and psychiatrists per capita of the child population is significantly decreasing.

Opinion polls confirm negative assessments of the health system and the acute shortage of doctors. According to the cohort monitoring data, despite the increase in satisfaction with medical care in the period from 1998 to 2020, the proportion of women who often face the problem of unavailability of specialist consultations and free medicines, including vitamins and drugs for widespread anemia, remains significant during pregnancy.

An assessment of the relative risk of a number of indicators characterizing, in our opinion, the organization and effectiveness of the healthcare system for the child's health has allowed us to identify the following links. The insufficient provision of medicines to a pregnant woman increases the risk of her child's developmental delay at one year and weight deficiency at 6 years of age. The future mother's

failure to receive medical care from specialized specialists is related to the enrollment of her child into a regular medical check-up at the age of 6. Difficulties in purchasing medicines in the first year of an infant's life increase the likelihood of a child's developmental delay, a decrease in health at an early age, and abnormalities in body weight and physical development at 6 years of age. The lack of access to specialist consultations at the age of 1, 3 and 6 is associated with a more frequent incidence of the child, physical and neuropsychiatric developmental disabilities, the risk of chronic diseases, enrollment into a regular medical check-up, and weight deficiency. Insufficient provision of the necessary equipment at a medical institution and limited financial resources to receive paid care more than double the risk of a child's enrollment into a regular medical check-up due to a chronic disease.

In this regard, we note that attention to the development of free qualified medical care of various specializations, the availability of medicines necessary for the treatment of expectant mothers and children, can help to increase the health potential of the population as a whole. This will certainly have a positive impact on the intellectual, reproductive and labor potential of the Russian population.

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