Children's and maternal morbidity, as a basic factor in public health in the Primorsky Krai of Russia

Dmitry S. Osmolovsky
Neurologist, Neurophysiologist
Head of the Center for Restorative Medicine and Rehabilitation
Krai Clinical Center for Specialized Types of Medical Care
Tatyana A. Gvozdenko
Doctor of Medical Sciences, Professor of the RAS
Director of the Vladivostok branch
Far Eastern Scientific Center of Respiratory Physiology and Pathology
Sergej L. Kolpakov
Candidate of Medical Sciences, Associate Professor
Pacific State Medical University
Sergey V. Osmolovsky
Candidate of Medical Sciences, Rehabilitation Physician
Center for Restorative Medicine and Rehabilitation
Krai Clinical Center for Specialized Types of Medical Care

Abstract. The article presents data on the study of morbidity and mortality in newborns and children in Primorsky Krai from 2009 to 2019. The morbidity of pregnant women, the state during pregnancy and complications of childbirth and postpartum activity in the same time period were analyzed. The calculation of statistical indicators based on long-term data and in the spatial aspect for the administrative-territorial formations of Primorsky Krai has been made. The leading territorial focus of stillbirth risk was the Primorskiy Krai districts located to the west and south of Lake Khanka. In the Khanka region, the forecast for the still-birth rate was 15.2 per 1,000 births. Stillbirth and prematurity in children had a moderately strong statistical relationship with hypertensive disorders (r=0.46; 0.31). They were most often formed in pregnant women in ecologically unfavorable areas. Nervous diseases of children were the only category of pathology that we examined, in which there is a statistical relationship with diseases of the genitourinary system of pregnant women (r=0.31). A significant statistical relationship was revealed between the presence of diseases of the circulatory system in pregnant women with mental disorders (r=0.38), nervous diseases (r=0.40), congenital anomalies in children (r=0.45).

Keywords: stillbirth, newborn mortality, children, diseases of the nervous system, congenital anomalies, mental disorders.

Introduction. A difficult demographic situation remains a medical and social health problem in the Russian Federation [1]. This is especially true of the Far Eastern region, in particular the Primorsky Krai [2]. In its solution, priority is given to aspects that shape the health of children: the prevention of stillbirth, prematurity, newborn mortality, morbidity with socially significant classes of pathology in

children, the health of women of childbearing age, the provision of medical care to pregnant women, childbirth.

Research on the identification of risk factors for the pathology of pregnant women, newborns and children plays an important role in the strategy of maintaining and strengthening the health of the country's population. Success has been achieved in the study of individual risks: biological, genetic, clinical factors [3; 4; 5; 6]. Residents of large and small cities have established the role of nutrition, physical activity, body weight, smoking, hypertension, hypercholesterolemia and other diseases [4]. Similar studies were carried out in rural areas [5]. Risk factors are also studied in the social sphere: in education, family and social status, interpersonal relationships, and living conditions [3]. The effectiveness of obstetric care institutions as a factor in children's health has been analyzed [1]. The role of non-term maturity in the formation of nervous and mental diseases in children has been established [7; 8]. However, with all the redundancy of information about individual risk factors, the question of the mechanisms of their implementation remains open. Does the prevalence of risk factors in the population correlate with the spatio-temporal characteristics of the pathology? With the same stillbirth, prematurity, morbidity in children and pregnant women. In systems theory, the position is well known that at a higher level of organization (population level relative to the individual level), the phenomenon is characterized by both quantitative and qualitative originality [9]. For prevention, planning of treatment measures and organization of medical care, it is important to know the mechanisms of interaction between individual and population risk factors.

Purpose of the study: to establish population risk factors for stillbirth, prematurity, newborn mortality, morbidity with socially significant pathology in Primorsky Krai. To achieve the goal, the following tasks were set: to study the territorial and temporal characteristics of pathology in newborns and children, pathological conditions in pregnant women and their impact on the health of children during pregnancy and complications of labor.

Materials and methods. The study used statistical data on the pathological conditions of newborns: stillbirth, prematurity, and newborn mortality in Primorsky Krai for the period from 2009 to 2018. We studied statistical data on socially significant classes of neonatal diseases: congenital anomalies of newborns. As well as diseases of children: congenital anomalies of children, nervous diseases, mental illnesses from 2009 to 2018. We used statistical data on diseases of pregnant women by classes: diseases of the endocrine and genitourinary systems, circulatory systems, anemia, hypertensive disorders, venous complications. According to these classes of diseases, statistical indicators of "detectability" were calculated in women (per 1000) from among those who completed pregnancy in childbirth.

Statistical data on the state of women during pregnancy were used: the threat of premature birth and termination of pregnancy, the pathological state of the fetus, Rh immunization.

For complications of labor and postpartum activities: detachment of the placenta, eclampsia, premature rupture of the membranes. The choice of the states of women during pregnancy and complications of childbirth and the postpartum period was determined by the possibility of statistical processing and analysis (frequency of events, completeness of data on objects). The study was carried out in the administrative-territorial formations of Primorsky Krai (31 objects).

Data on primary and general childhood morbidity were obtained from the statistical reports "Basic indicators of medical services for the population of Primorsky Krai", reporting form No. 12. Analyzed the statistical indicators for administrative-territorial entities from the annual information and statistical reference books of the information and analytical center of the Department of Health of Primorsky Krai "Health of the population and healthcare of Primorsky Krai". The article presents the average and prognostic indicators of the period under consideration. Stillbirth statistics were calculated in ppm per 1,000 births (‰). Newborn mortality - per 100 observations (%). Prematurity rates per 1,000 births (‰). Incidence (newly diagnosed cases) and prevalence (overall incidence, prevalence) were calculated per 100,000 child population (‰‰). Statistical indicators of the detection of pathology in pregnant women, pathological conditions during pregnancy, complications of childbirth and the postpartum period are calculated for 1,000 observations (‰).

To analyze statistical data, assess the epidemiological situation, study the territorial distribution of statistical indicators, and correlation analysis, prognostic values were used. They have an advantage over average indicators in that they take into account the long-term trend and reflect the epidemiological situation at the current time [10]. Based on the regression equation, predictive values of all studied statistical variables were obtained.

To establish a statistical relationship, a correlation was made between the prognostic indicators of the state of newborns and the incidence of children with socially significant classes of diseases with the prognosis of the detection of diseases by the main classes in pregnant women in the administrative-territorial entities of Primorsky Krai. And also with forecasts of pathological conditions during pregnancy and complications of childbirth and postpartum activities. Statistical analysis was carried out on the basis of Microsoft Office Excel.

Results. The formation of the state of health of children can be represented in a chain of cause-and-effect relationships: born alive - stillborn; newborn alive - newborn deceased; healthy newborns - sick newborns; healthy children are sick children. In this sequence, the first level (live birth) is characterized by statistical indicators of stillbirth. We are considering the population factors of this phenomenon on the model of the territorial distribution of stillbirth in the administrative-territorial formations of Primorsky Krai. To level out random factors, as well as to take into account the patterns (long-term trend) as much as possible, the forecasts of stillbirth and infant mortality were calculated.

The leading territorial focus of stillbirth risk was the Primorskiy Krai areas located to the west and south of Lake Khanka, bordering the PRC. This is the Khanka region, the forecast for the stillbirth rate is 15.2 per 1,000 births. Border region - 11.2 per 1,000 births. Oktyabrsky district - 9.5 per 1,000 births. Ussuriysk and Ussuriysk district - 7.4 per 1,000 births. The mosaic nature of the risk areas is associated with the increased rates of Luchegorsk, Lesozavodsk and Partizansk, small towns of Primorsky Krai with industrial city-forming enterprises.

The territorial distribution of forecasts for infant mortality had a completely different character. First, the rates were significantly higher. The average stillbirth rate in one area is 4.8 per 1,000 births, and the average newborn death rate is 3.3 per 100 live births. Secondly, the territories at risk for the death of a newborn were remote areas of Primorsky Krai. The mortality forecast in the Kavalerovsky district was 6.2 per 100 live births; Pozharsky district - 4.7%; Dalnerechensk and Dalnerechensk region - 4.4%. In the rest of the territories, there is a tendency towards a decrease in infant mortality rates and the forecast values are below average.

The territorial distribution of prematurity prediction indicators in Primorsky Krai by risk areas was mosaic. With an average statistical indicator of prematurity of 19.7 per 1,000 births, the maximum values were in the city of Spassk-Dalny and Spassky districts (47.4 per 1,000 births); Terneisky district (43.8;); Artem (35.2 ‰); Krasnoarmeisky district (33.8 ‰); Border area (32.5 ‰). The distribution patterns of prematurity differed from stillbirth and neonatal mortality.

To establish the general nature of the formation of pathology, a correlation analysis was carried out. It does not reveal a statistical relationship between stillbirth and neonatal mortality (r=-0.17); prematurity and neonatal mortality (r=-0.02). However, between prematurity and stillbirth, there is a positive statistical relationship of average strength (r=0.39), which allows us to speak about the general population and pathogenetic mechanism of the formation of prematurity and stillbirth. At the same time, differences in the territorial nature of pathology and a low statistical relationship suggest that environmental factors have a greater influence on stillbirth, and individual factors of parents (mothers) have a greater effect on prematurity.

Table 1

The statistical relationship between pediatric pathology and the condition of pregnant women.

Conditions and diseases of children	Diseases of pregnant women					
	endocrine system	genitourinary system	circulatory system	anemia	Hypertensive disorders	venous complications
stillbirth	0.16	-0.05	0.21	-0.10	0.46	0
infant mortality	0.02	-0.08	-0.03	-0.02	-0.20	-0.17
prematurity	0	-0.24	0.26	-0.11	0.31	0
congenital anomalies of children	0.18	0.14	0.45	-0.07	-0.11	0.60
congenital anomalies of	0.21	0.01	-0.09	0.14	0.14	0.28

newborns						
nervous diseases	0.13	0.31	0.40	0.13	-0.07	0.26
mental disorders	-0.13	0.03	0.38	-0.15	0.10	0.33

The study of statistical relationships between stillbirth, infant mortality and prematurity with diseases of pregnant women, possibly, shows the presence of causal relationships and risk factors (tab. 1). Thus, diseases of pregnant women did not have a statistically significant effect on the mortality of newborns. However, they had a statistically significant effect on prematurity and stillbirth. First of all, we are talking about hypertensive disorders.The statistical relationship between stillbirth and the presence of hypertensive disorders during pregnancy was moderately strong, positive (r=0.46). A similar statistical relationship, at the border of moderate and weak strength, was found between hypertensive disorders and prematurity (r=0.31). The risk areas for the detection of hypertensive disorders in pregnant women were Khankaisky district (20.3 per 1,000 women who completed pregnancy with childbirth), Khasansky district (19.5 ‰) and Pogranichny district (15.1 ‰). These are the southern regions of Primorsky Krai, bordering the PRC. The main occupation of the population is agricultural plant growing (rice, soybeans, corn ...). Increased rates of detection of hypertensive disorders were observed in pregnant women in the remote, northern territories of Primorsky Krai. These are Krasnoarmeisky District (13.0 ‰), Dalnegorsk and Dalnegorsk District (12.7 ‰), Luchegorsk City and Pozharsky District (8.8 ‰). These are territories with a harsh climate and developed industrial production. In general, the nature of the territorial distribution of hypertensive disorders (the presence of risk zones) suggests the predominance of climatic and environmental risk factors over the individual risk factors of pregnant women.

As the main socially significant pathology of children, we studied the incidence of congenital anomalies, the incidence of nervous and mental diseases. The presence of statistical links between these classes of diseases in children and the incidence of diseases in pregnant women (detection of diseases) has been analyzed. The presence of an average strength of the statistical relationship between venous complications in pregnant women and the incidence of congenital anomalies in children (r=0.60) was established. At the same time, the statistical relationship with the incidence of congenital anomalies in newborns was significantly lower (r=0.28). Venous complications in pregnant women were also statistically associated with the incidence of mental illness in children (r=0.33). To a lesser extent - with nervous diseases of children (r=0.26). In this regard, it should be noted that the nervous diseases of children are the only category of pathology that we have considered, in which there is a statistical connection with diseases of the genitourinary system of pregnant women (r=0.31). Probably, there may be a direct etiological and pathogenetic role of infectious pathology.

The presence of a significant statistical relationship between the detection of diseases of the circulatory system in pregnant women with socially significant pathology of children was revealed. With mental disorders (r=0.38), nervous diseases (r=0.40), congenital anomalies in children (r=0.45).

At the same time, there was no statistical relationship with congenital anomalies of newborns (r=-0.09). This is probably due to the fact that predominantly congenital anomalies of a hereditary nature are detected in the maternity hospital. And in children, congenital anomalies are detected, acquired in the process of intrauterine development.

The features of the territorial distribution of the prognosis of diseases of the circulatory system in pregnant women, at first glance, do not have a natural character. Territories at risk are Oktyabrsky District (20.2 per 1,000 pregnant women), Artem (14.4 ‰), Nakhodka (13.6 ‰), Krasnoarmeisky District (10.1 ‰). Therefore, in identifying risk factors for diseases of the circulatory system, one should look for a pathogenetic mechanism that explains the territorial distribution of indicators.

The presence of statistical relationships between the states and diseases of newborns and children and the state of women during pregnancy was studied (tab. 2). There were no significant statistical associations with stillbirth, neonatal mortality and prematurity. In general, this indicates the effectiveness of treatment measures and the provision of medical care to pregnant women. In the formation of socially significant pathology, a statistical relationship was established on the border of weak and medium strength with the pathological state of the fetus. With mental disorders (r=0.31), nervous diseases (r=0.29) and congenital anomalies of children (r=0.15).

The presence of a negative statistical relationship between medical care for pregnant women with a pathological state of the fetus and prematurity of newborns (r=-0.36) was established. In other words, there is a therapeutic and prophylactic effect. Negative statistical relationship between stillbirth and the threat of termination of pregnancy (r=-0.12), pathological state of the fetus (r=-0.11) and Rh immunization (r=-0.11). The statistical feedback is weak, but there is a general tendency for the presence of a preventive effect of stillbirth in women in labor receiving medical care in the presence of pregnancy pathology.

Table 2

Statistical relationship of diseases of newborns and children with the condition of pregnant women

Conditions and diseases of children	Conditions during pregnancy			
	Threat of premature birth	The threat of termination of pregnancy	Pathological condition of the fetus	Rh immunization
stillbirth	0.27	-0.12	-0.11	-0.11
infant mortality	0.18	0.22	0.14	-0.07
prematurity	0.13	0.16	-0.36	0.07
congenital anomalies of children	0.02	-0.23	0.15	0.10
nervous diseases	0.16	-0.07	0.29	-0.01
mental disorders	-0.04	-0.21	0.31	0.18

In a number of cases, the presence of statistical links between complications of childbirth and postpartum activity with the conditions and pathology of children was revealed (tab. 3). A statistical relationship of moderate strength was established between eclampsia and the presence of congenital

anomalies (r=0.32). Between placental abruption and prematurity (r=0.36). Labor complications did not affect neonatal mortality. On the contrary, in all types of complications of childbirth had a weak positive statistical relationship with stillbirth. In general, the data obtained can be regarded as a reflection of effective medical care in the conditions of acutely emerging complications of childbirth and postpartum activity.

Table 3

Statistical relationship of conditions and diseases of newborns and children with complications childbirth and postpartum activities.

Conditions and diseases of children	Complications of childbirth and postpartum activities		
	detachment of the placenta	eclampsia	premature rupture of fruit membranes
stillbirth	0.27	0.16	0.28
infant mortality	0.02	0.02	-0.11
prematurity	0.36	0.09	0.23
congenital anomalies	0.03	0.32	0.02
nervous diseases	0.19	0.18	0.15
mental disorders	0.00	0.00	-0.19

Thus, the study of the patterns and features of the territorial distribution of the detection of pathology in pregnant women shows the presence of statistical and causal relationships with stillbirth, prematurity and socially significant diseases of children. At the same time, there is no reason to believe that the distribution of individual behavioral risk factors (smoking, nutrition, education ...) can have similar spatial and temporal characteristics. Rather, a normal distribution pattern in the population with a predominance of mean levels should be expected. Since the frequency of occurrence of individual risk factors in the population of working adults is very high (smoking - 35%; overweight - 64%; hypercholesterolemia - 35% ...) [4], the incidence rates are formed in association with them. But at the same time enough, regardless of their prevalence. Population mechanisms based on individual risk factors are regulators of the incidence rates of women of childbearing age and children, stillbirth and prematurity.

Stillbirth and prematurity in children were statistically associated with hypertensive disorders (r=0.46; 0.31). They, in turn, were formed in pregnant women in ecologically unfavorable areas with less quality medical care. Therefore, as a population mechanism, one can consider the ecological dependence of the incidence (through water, food, occupational factors). Territories of risk for infant mortality were extremely remote areas where it is difficult to receive timely qualified medical care. This corresponds to the model of WHO experts on the factors that determine health: medical provision accounts for 8-12%, and the environment - 15-20% [10].

In the formation of socially significant pathology of children in Primorsky Krai, by the strength of statistical connections, the presence of heart and circulatory system diseases in pregnant women plays an important role. As well as the associated pathogenetic venous complications. It is difficult to

explain the territorial features of the incidence of diseases of the circulatory system in pregnant women by climate, ecology, social factors, and the provision of medical care (fig. 5). Previously, we studied the mechanisms of the formation of the incidence of streptococcal group A infection, acute rheumatic fever and chronic rheumatic heart disease in Primorsky Krai. A territorial model of the epidemic process with areas of risk of morbidity was developed [11]. The spatial distribution of heart and circulatory system diseases in pregnant women is fully consistent with this model. Therefore, we formulated a hypothesis that the territories at risk for congenital anomalies detected in children are formed on the basis of the pathogenetic mechanisms of the incidence of rheumatism. And how indirectly, through the pathological conditions of the mother. So directly, as an autoimmune, post-streptococcal congenital disease of the newborn. In the sources available to us, such a mechanism and its possibility are not described.

In conclusion, we note the positive, preventive effect of providing medical care to women with pregnancy pathology. And also with complications during childbirth. Even with a high risk of stillbirth and pathology in newborns and children, there is no significant statistical relationship. And in some cases, feedback is noted as a positive effect of therapeutic measures.

Conclusions.

1. When studying the morbidity of pregnant women, stillbirth, infant mortality and morbidity in children with diseases of the nervous system, congenital anomalies and mental disorders, a regular pattern of spatial distribution over the territories of Primorsky Krai was revealed.

2. The coincidence of the patterns of the territorial distribution of pathology in pregnant women with stillbirth, mortality and morbidity in children was established.

3. The main classes of pathology in pregnant women that determine stillbirth, mortality and morbidity in children are diseases of the heart and circulatory system, hypertensive disorders, and venous complications.

References.

1. N.V. Vartapetova Mortality indicators of full-term babies and stillbirths – as factors of the quality of organization of work of obstetric institutions / N.V. Vartapetova // Information and analytical bulletin "Social aspects of population health". – 2010.- 13.09.- URL: http://vestnik.mednet.ru/content/view/227/30/ (appeal date: 04.02.2021).

2. Gorshunova G.P. Modern technologies to reduce perinatal losses: abstr. diss. ... cand. med. sci.: 14.00.09, 14.00.33 / Gorshunova Galina Petrovna; stat. med. un-ty. - Vladivostok, 2003. - 25 P.

3. Family and non-family risk factors for stillbirth / T.G. Denisova, A.V. Samoilova, L.I. Gerasimova, N.V. Belova // Bulletin of the Chuvash University. - 2006.- № 2.- P.99-107.

4. Oranskaya I.I. The prevalence of risk factors among the population of an industrial city / I.I. Oranskaya, O.S. Starodubtseva, S.P. Sokolov // Fundamental research. - 2012.- №8. - P. 127-130.

5. Bolotova E.V. Features of the prevalence of risk factors for cardiovascular diseases in the rural population of Krasnodar Krai / E.V. Bolotova, I.M. Komissarova // Fundamental research. - 2013.- №7.- P. 514-517.

6. Vasilyeva E.N. Some features of the genotype in patients with preeclampsia / E.N. Vasilieva, L.I. Maltseva, L.I. Gerasimova, T.G. Denisova, T.N. Sidorova // Mother and child: mater. All-Russian. sci. - pract. conf / M., 2016.- P.19-20.

7. Chukhutova G.L. Prematurity as a factor of impaired child development / G.L. Chukhutova // Modern foreign psychology. - 2014.- №1.- P. 72-81.

8. Bakushkina N.I. Prematurity as a risk factor for developmental deviations in children of early age / N.I. Bakushkina, T.V. Rogacheva // Personality in a changing world: health, adaptation, development. Volume 7. - 2019.- № 2 (25).- P. 390-401.

9. Belyakov V.D. Selected lectures on the general epidemiology of infectious and non-infectious diseases / V.D. Belyakov. - Moscow: Medicine, 1995.- 176 P.

9. Kolpakov S.L. On the methodology for assessing the epidemiological situation / S.L. Kolpakov, A.A. Yakovlev // Epidemiology and infectious diseases. 2015.- №20 (4).- P. 34-39.

10. Lisitsin Yu.P. The concept of risk factors and lifestyle / Yu.P. Lisitsin // Healthcare of the Russian Federation.- 1998.- №3.- P. 49-52.

11. Kolpakov S.L. Population mechanisms of the incidence of respiratory streptococcal infection and rheumatism in Primorsky Krai / S.L. Kolpakov, A.A. Yakovlev, M.A. Ginkul // Pacific Medical Journal.- 2003. - №2- P. 48 – 52.