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CAUSES AND MORTALITY INDICATORS OF CHILD POPULATION IN THE ARCTIC REGIONS OF THE REPUBLIC SAKHA (YAKUTIA)

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The issue of medical aid improvement in the remote areas is a lot discussed at circumpolar Union meetings. It is clear that healthcare of the Arctic regions populations depends on the welfare of the country. However, we should notice that there are certain improvements in this field in the Republic Sakha (Yakutia). That is why it is actual to evaluate the mortality rate of the child population in the Arctic regions when huge government financed programs concerning maternity and childhood welfare are being held in the Republic Sakha (Yakutia). The article represents the official data of mortality rate in the child population of the five Arctic regions of the Republic Sakha (Yakutia) for the period of 2006-2018. For further detailed analysis of the child mortality a special database of the state institution "Yakut Republican medical information and analytical center of the Ministry of healthcare of the Republic Sakha (Yakutia)" was used. The database included all cases of mortality from 0 to 18 years of age for the period of 2006-2015, indicating the age, gender, nationality and causes of the death. The analysis of the mortality rate in the Arctic regions of the Republic Sakha (Yakutia) has revealed significant decrease of infant mortality from 29.8% to 4.2%, decrease of child mortality rate from 6.3% to 2.3%. On a whole, a decrease to the minimum level of the mortality rate in the child population of the Republic Sakha (Yakutia) can be constituted.

Key words: children, mortality, Arctic, external causes, injury, poisoning.

Introduction. The examination of the health status and factors of its formation in the Arctic regions has greatly increased in the recent years. It is associated with the realization of huge governmental projects concerning the development of industrial, transport and energy sectors in Russia. The main and high priority of scientific investigations in Yakutia is associated with the Arctic coast inhabiting people health. All circumpolar community studies phenomenal viability of the Arctic population [4]. It undoubtedly concerns the health of the coming generation, i.e. children of the Arctic [2, 3, 5]. The Ministry of the healthcare in the Republic Sakha (Yakutia) has realized several federal and Republican programs to improve logistic and material support, medical personnel staffing in different medical institutions of the Arctic and Northern regions, undoubtedly it had an effect on the indicators of the health state of the population in the Artic regions and the Far North [1, 2, 4]. The child mortality issues are being discussed a lot at the meetings of the circumpolar territories community [6, 7].

Objectives: The objectives are to analyze the child mortality in the Arctic regions of the Republic Sakha (Yakutia).

Materials and methods: We have analyzed the official medical data of child population in 5 Arctic coast regions of the Republic Sakha (Yakutia) for the period of 2006-2018. For further detailed analysis of the child mortality a special database of the state institution "Yakut Republican medical information and analytical center of the Ministry of healthcare of the Republic Sakha (Yakutia)" was used. The database included all the cases of mortality from 0 to 18 years of age for the period of 2006-2015, indicating the age, gender, nationality and causes of the death.

Results: According to the data from "Yakut Republican medical information and analytical center of the Ministry of healthcare of the Republic Sakha (Yakutia)", the mean indicator of the infant mortality has shown clear decrease from 17.0% in 2011 to 4.2% in 2018 (Table 1). In 2018 the infant mortality rate has decreased to its historical minimum. For the following periods, there are several regions were no cases of infant mortality were registered (Allaikhovskiy (2012,2016, 2018), Anabarskiy (2016,2018), Bulunskiy (2014,2015,2017), Nizhne-Kolymskiy (2014, 2017,2018), Ust-Yanskiy (2015)). Infant mortality rate is one of the demographic factors that denote the level of healthcare development in the region. Such federal and Republican programs like "Public health and healthcare modernization" resulted in decrease of infant mortality in the Republic and the Arctic regions of the Republic Sakha (Yakutia) (see table 1).

As we can see in the table 2 the mortality rate from 0-18 in the Arctic regions tends to decrease, although the index is quite unstable for the period of 2006-2018. The index of mortality for the mentioned period tends to decrease up to 2.9% in 2016, and increase up to 8.1% in 2010.

A detailed analysis of the child mortality rate in the Arctic regions of the Republic Sakha (Yakutia) is based on the data of the Yakut Republican medical information and analytical center. This database is composed of all the cases of mortality from 2006 to 2015.

The child mortality rate dynamics is represented in the table 3. It is obviously seen that in standardization of indices the mortality rate, concerning the number of child population, in the Artic regions is higher than the same in the Republic, except 2015.

As we can see in the table 4, the part of mortality rate in boys, aged from

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Table 1

Dynamics of infant mortality in the Arctic regions of the Republic Sakha (Yakutia), (per 1000 of child population, %)

Regions	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Allaikhovskiy	40.8	…	…	…	…	18.5	…	20.0	15.4	18.9	…	25.0	…
Anabarskiy	36.6	13.0	54.7	…	18.2	14.7	15.6	12.7	12.7	13.3	…	13.0	…
Bulunskiy	16.8	15.0	…	16.4	16.0	20.0	14.0	7.0	…	…	16.0	…	10.5
Nizhnekolymskiy	54.9	11.0	26.0	36.2	41.5	12.8	13.3	12.2	…	12.7	14.7	…	…
Ust-Yanskiy	…	…	…	28.9	20.8	19.2	31.5	16.1	6.8	…	17.9	18.0	10.8
Total for the Arctic regions	29.8	7.8	16.1	16.3	19.3	17.0	14.9	16.3	7.3	8.9	9.7	11.2	4.2
Republic Sakha (Yakutia)	10.6	10.4	9.1	8.9	7.2	6.3	9.6	9.6	8.0	7.6	7.2	5.1	5.0
Russian Federation	10.2	9.4	8.5	8.1	7.5	7.4	8.6	8.2	7.4	6.5	6.0	5.6	5.1

Table 2

Mortality cases in children and adolescents in the Arctic regions of the Republic Sakha (Yakutia)

Regions	Абс. число												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Allaikhovskiy	5	2	0	1	1	2	1	1	4	0	0	1	0
Anabarskiy	7	3	4	2	4	2	4	1	1	1	0	1	1
Bulunskiy	3	8	4	3	5	6	4	3	2	0	2	1	2
Nizhnekolymskiy	8	2	3	6	4	0	0	1	3	0	2	0	0
Ust-Yanskiy	3	3	2	4	5	4	6	8	4	2	2	3	1
Total for the Arctic regions	26	18	13	16	19	14	15	14	14	3	6	6	4
Arctic regions, %	6.3	4.7	3.6	5.7	8.1	6.8	6.8	6.3	6.4	1.5	2.9	3.7	2.3
Republic Sakha (Yakutia)	412	387	361	280	232	206	220	220	217	194	207	160	173

Table 3

Child mortality rate coefficient dynamics in the Arctic regions of the Republic Sakha (Yakutia)

Район	Mortality rate per 1000 of child population, ‰									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Allaikhovskiy	5.444	2.232	0.000	1.123	1.111	2.250	1.140	1.159	4.709	0.000
Anabarskiy	4.754	2.123	3.034	1.567	3.120	1.591	3.252	0.816	0.824	0.833
Bulunskiy	1.124	3.097	1.600	1.225	2.051	2.414	1.621	1.267	0.866	0.000
Nizhnekolymskiy	5.722	1.455	2.199	4.478	3.059	0.000	0.000	0.766	2.275	0.000
Ust-Yanskiy	1.316	1.408	0.931	1.879	2.339	1.885	2.850	3.839	1.928	0.958
Total for the Arctic regions	2.976	2.143	1.584	1.979	2.356	1.737	1.879	1.785	1.803	0.388
Republic Sakha (Yakutia)	1.535	1.472	1.399	1.101	0.918	0.814	0.867	0.863	0.845	0.747

0 to 18 is 65% in 2006, and 33% in 2015. The mortality rate in girls composed 35% in 2006, and 67% in 2015. It is obvious that the rate is significantly higher in boys from 2006 to 2014, the death was caused by external factors like traumas, to which the boys seem more predisposed than the girls. In 2015 there were 3 cases in the whole structure of the mortality rate, 2 were caused by external factors and 1 was a case of a sudden death.

As we can see in the table 5, the main cause of mortality in child population aged from 0 to 18 is associated with external factors. The part of mortality caused by external factors composed 46% in 2006, 59% in 2007, 30% in 2008, 31% in 2009, 21% in 2010, 28% in 2011, 33% in 2012, 71% in 2013, 35% in 2014, 66% in 2015. The next factors of mortality are injuries, poisoning, and other perinatal conditions. On a whole, we can constitute that the external factor causing mortality in children prevails. An achieved decrease of the infant mortality is smoothed by increase of mortality in adolescents, caused by injuries.

Conclusion: The analysis of the child mortality in the Republic Sakha (Yakutia) revealed the following tendencies. A marked decrease of the infant mortality rate from 29.8% to 4.2% is noticed in the period from 2006 to 2018. The level of the infant mortality rate in the Arctic regions is considerably higher than the rate in the other regions of the Republic Sakha (Yakutia) and the average numbers in Russia (5.0% in the Republic Sakha (Yakutia) and 5.1% in the Russian Federation in 2018). The results reveal the necessity of developing a new 3-level system of medical assistance for pregnant and parturient women and the system of their routing from the Arctic regions of the Republic Sakha (Yakutia).

On a whole the level of child mortality in the Arctic regions of the Republic Sakha (Yakutia) was 6.3% in 2006, and

Table 4

Gender based mortality cases dynamics in child population of the Arctic regions of the Republic Sakha (Yakutia)

Regions		Абс. число									
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Allaikhovskiy	M	5	1	0	1	1	1	1	0	2	0
	F	0	1	0	0	0	1	0	1	2	0
Anabarskiy	M	6	1	2	1	3	2	3	1	1	0
	F	1	2	2	1	1	0	1	0	0	1
Bulunskiy	M	1	7	4	1	3	3	1	3	1	0
	F	2	1	0	2	2	3	3	0	1	0
Nizhnekolymskiy	M	5	0	3	1	1	0	0	0	2	0
	F	3	2	0	5	3	0	0	1	1	0
Ust-Yanskiy	M	0	3	2	2	1	2	4	5	3	1
	F	3	0	0	2	4	2	2	3	1	1
Total for the Arctic regions of the Republic Sakha (Yakutia)	M	17	12	11	6	9	8	9	9	9	1
	%	65	66	84	37	47	57	60	64	64	33
	F	9	6	2	10	10	6	6	5	5	2
	%	35	34	16	63	53	43	40	36	36	67

Table 5

The dynamics of child mortality causes in the Arctic regions of the Republic Sakha (Yakutia), (absolute numbers)

Pathology structure	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total deaths	26	18	13	16	19	14	15	14	14	3
External causes of morbidity and mortality	12	9	4	5	4	4	5	10	5	2
Different perinatal conditions	10	8	8	2		2				
Injuries, poisoning and some other outcomes of external factors				4	3	4	2	3	2	
Diseases of the nervous system					4	2	2	1		
Some infectious diseases and parasite disorders					1					
Malformations									1	
Diseases of blood, hemopoietic organs, and other disorders involving immune mechanism						1				
Circulatory system disorders				1	1	1	2		2	
Disorders of the respiratory system	1	1		2	2				2	
Diseases of the digestive organs							2			
Diseases of the muskuloskeletal system and connective tissue					1					
Inherited defects (birth defects), deformities and chromosome disorders	3								1	
Signs and symptoms of the defects, revealed during the clinical and laboratory tests, not included in the classification				2	2		2		1	1
Sudden death syndrome				2			2		1	1

2.3% in 2018. A considerable decrease up to the minimum of numbers of child mortality rate aged from 0 to 18 is noticed in the Arctic regions of the Republic Sakha (Yakutia).

From 2006 to 2015 the child mortality rate aged from 0 to 18 decreased from 2.976% to 0.388% in the Arctic regions of the Republic Sakha (Yakutia). Before 2014 the mortality rate in the Arctic regions was higher than the average numbers in the other regions of the Republic Sakha (Yakutia) (0.845% in 2014 in the Republic Sakha (Yakutia)). The mortality rate caused by the external factors tends to decrease in the Arctic regions of the Republic Sakha (Yakutia). Singular cases of child mortality were registered in 2015.

Extreme conditions of inhabiting in the Arctic regions demand differentiated approach in the development of regional mechanisms of the state policy in the field of healthcare and health service in the Far North of the Russian Federation. A possible development of medical subprogram should also be taken into account, as it can result in targeted modeling of the healthcare for the Arctic regions and decrease of child mortality rate. It should be noted that such Arctic model of healthcare should include not only practical support from practicing physicians but also scientific background.

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THE ROLE OF MATRIX METALLOPROTEINASES AND THEIR INHIBITORS IN PATIENTS WITH LOCAL COLD INJURY

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The urgency of the local cold injury (LCI) on the territory of the Russian Federation is conditioned by its geographical position, significant specific weight in the structure of the general traumatism, difficulties of etiopathogenetic therapy, disappointing treatment results, which leads to frequent loss of ability to work and permanent disability.

The aim of the study was to identify the dynamics of the level of collagenases of the second subfamily (MMR-2, MMR-9) and their inhibitors (TIMP-1 and TIMP-2) in the blood of those, who sustained local cold injury.

The study included 60 patients with frostbite of the distal segments of the lower extremities. The level of MMR–2, MMR–9, TIMP -1 and TIMP - 2 was studied on the 5th and 30th days after the frostbite using a multiplex blood test with a set of biomedical reagents.

In patients with frostbite, the level of MMR–2 and MMR–9 in the blood serum increases relative to the control group in the early stages of cryodamage, as well as an increase in the index of the markers studied directly proportional to the volume of the affected tissues. A similar dynamics was observed in the study of parameters of matrix metalloproteinase inhibitors. Based on the obtained data and analysis of the linear regression equation, a predictive model was formed that allows us to suspect the level of tissue damage in the early stages of local cold injury with high accuracy.

Keywords: local cold injury, endothelial dysfunction, matrix metalloproteinases, inhibitors of matrix metalloproteinases.

The urgency of the local cold injury (LCI) on the territory of the Russian Federation is conditioned by its geographical position, significant specific weight in the structure of the general traumatism, difficulties of etiopathogenetic therapy, disappointing treatment results [4,7,8]. The frequent loss of ability to work and high percentage of disability indicate the need for further studies of pathogenetic mechanisms of cryodamage. The study and identification of new markers of local cold injury contributes to an earlier diagnosis of the volume of tissue lesions, the creation of qualitatively new approaches to the complex treatment of frostbite of the extremities, as well as successful and fastest rehabilitation of patients [1, 8].

In recent years, scientific works clearly show the deepening of research by domestic and foreign authors on the features of the pathogenesis of cryodamage, early diagnosis of the volume of affected tissues, methods of surgical treatment of deep frostbite of the extremities and rehabilitation of patients [4, 8].

There is no doubt that endothelial dysfunction plays a fundamental role in the pathogenesis of frostbite [7-10]. Endotheliocytes damaged by cold and secondary alterations, as well as cells attracted to the focus of inflammation, increase a large number of biologically active substances, including matrix metalloproteinases (MMR) and their inhibitors (TIMP).

Recent studies have shown that collagenases, as well as their inhibitors, play a significant role in the pathogenesis of connective tissue damage and its fibrosis in various pathologies [2]. Collagenases are Zn2+ and Ca2+ dependent induced endogenous peptidases involved in tissue rearrangement, by the destruction of its organic components, as well as the exchange of proteins of the interstitial matrix [2, 3]. MMR secretion is influenced by cytokines released by endotheliocytes, fibroblasts, macrophages, platelets [3, 10].

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