managerial knowledge and skills it is possible to form specialists who are able to function effectively in modern socio-economic conditions and ensure sustainable development of health care industry.

The authors declare no conflict of interest in the submitted article.

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S.S. Sleptsova, S.S. Sleptsov, T.E. Burtseva, N.A. Ilyina

ORGANIZING MEDICAL CARE FOR CORONAVIRUS INFECTION IN THE YAKUT ARCTIC

The article presents a retrospective analysis of COVID-19 morbidity and mortality in the Arctic zone of the Republic of Sakha (Yakutia), and also considers key aspects of organizing medical care during a pandemic in this territory, which differs significantly in all conditions from most of the region.

In 2020, the incidence of COVID-19 in the Yakut Arctic exceeded the Russian average by 2 times, the republican average - by 1.8 times, by 2023 the share in the Arctic zone of the Republic of Sakha (Yakutia) in the overall morbidity structure decreased. For 2019-2023. In the Arctic zone of the Republic of Sakha (Yakutia), 211 deaths were recorded (6.2% of the total number in the republic), the peak of mortality occurred in 2021 (124 cases) due to the spread of the Delta strain.

The COVID-19 pandemic has clearly demonstrated that in the modern world, the inaccessibility of populated areas does not guarantee their epidemiological safety. The experience gained emphasizes the need for investment in equipping remote medical institutions, digitalization of healthcare and adaptation of anti-epidemic measures taking into account the geographical and social characteristics of the Arctic.

Keywords: coronavirus infection, COVID-19, Yakutia, Arctic zone, extreme climate, organization of medical care.

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SLEPTSOVA Snezhana Spiridonovna – MD, Associate Professor, Head of the Department of Infectious Diseases, Phthisiology and Dermatovenereology of the Medical Institute of the Federal State Autonomous Educational Institution of Higher Education, M.K. Ammosov North-Eastern Federal University, Yakutsk, e-mail: sssleptsova@yandex.ru, ORCID 0000-0002-0103-4750; **SLEPTSOV Spiridon Spiridonovich** – Candidate of Biological Sciences, Associate Professor, Senior Researcher at the Laboratory of Clinical-Population and Medical-Social Research of the Yakut Science Center of Complex Medical Problems, e-mail: sachaja@yandex.ru, + 7 924-165-78-35, ORCID 0000-0002-2482-2928; **BURTSEVA Tatyana Egorovna** – Doctor of Medical Sciences, Associate Professor, Professor of the Department of Pediatrics and Pediatric Surgery of the Medical Institute of the Federal State Autonomous Educational Institution of Higher Education, M.K. Ammosov North-Eastern Federal University, Yakutsk, e-mail: bourtsevat@yandex.ru; **ILYINA Natalina Aleksandrovna** – assistant at the Department of Infectious Diseases, Phthisiology and Dermatovenerology, Medical Institute of the Federal State Autonomous Educational Institution of Higher Education M.K. Ammosov North-Eastern Federal University, Yakutsk, e-mail: bnatalinush@mail.ru, ORCID 0000-0002-9458-403X

Introduction. In the Republic of Sakha (Yakutia), the first case of COVID-19 was recorded on March 17, 2020, and according to data from March 18, 2025, 247,602 cases of the disease were registered in the region with a cumulative number of deaths equal to 2,169 cases (fatality rate 0.88%) [1, 5].

The Yakut Arctic is characterized not only by extreme climatic conditions and a vast territory, but also by poorly developed transport infrastructure. Of the 84 settlements in the Arctic zones of the Republic of Sakha (Yakutia), about half are located more than 100 km (by air) from their district centers, and more than 80% have no land communication with them for six months or more. For example, the village. Kharyyalakh of the Olenek district, located just 2 km from the district center, remains cut off from the Central Regional Hospital in the spring and autumn. Theoretically, these facts should have contained the spread of the infection, but this was not observed. Moreover, the organization of anti-epidemic measures, includ-

ing the deployment of hospitals, provision of medicines, diagnostic tests, etc., in the Yakut Arctic was achieved with significant difficulties and financial costs.

Objective: to analyze the incidence and mortality of the population from coronavirus infection in the Arctic zone of the Republic of Sakha (Yakutia) and the organization of medical care during the pandemic.

Materials and methods: The article presents a retrospective analysis of the incidence and mortality of the population from coronavirus infection in the Arctic zones of the Republic of Sakha (Yakutia) for 2020-2023 based on official statistics of the Territorial Administration of Rospotrebnadzor in the Republic of Sakha (Yakutia) and reporting forms of the Ministry of Health of the Republic of Sakha (Yakutia). To calculate indicators reflecting the intensity of the epidemic process with COVID-19, information on the population of the republic and the Arctic regions provided by the State Statistics Committee of the Republic of Sakha (Yakutia) was used. The real positive experience of organizing medical care for the population in the Arctic zones of the Republic of Sakha (Yakutia) during the coronavirus pandemic is described.

Results. It is well known that the level of social activity of the population directly affects the intensity of the epidemic process. In this regard, immediately after humanity realized the danger of COVID-19, various restrictive measures were introduced around the world [6]. However, in the vast majority of countries, it led to a colossal overload in the field of healthcare and millions of human casualties [8, 11]. In Russia alone, in 2020-2021, COVID-19 claimed the lives of at least 600 thousand people. In addition, such sectors of activity as transport, culture, sports, tourism, education, etc. suffered everywhere [4, 7, 9, 10]. Of course, Yakutia was no exception.

In March 2020, a decree of the head of the region banned mass events (with the exception of settlements that do not have year-round motor transport) and suspended the activities of shopping centers, gyms, computer clubs, etc[1]. On April 2, 2020, when 15 cases of the disease were noted in the Republic of Sakha (Yakutia), restrictive measures were introduced in organizations with round-the-clock presence of people[2]. In May 2020, the above-mentioned decree of the head of the republic was supplemented with a clause on mandatory 14-day quarantine for those arriving in Yakutia from other subjects of the Russian Federation (with the exception of employees of transport and logistics companies, law enforcement agencies and some other categories of citizens).

Table 1

The number of telemedicine consultations on COVID-19 issues conducted with central district hospitals in the Arctic zones of the Republic of Sakha (Yakutia)

District	Years			
	2020	2021	2022	2020-2022
Abyisky	14	29	11	54
Allaikhovsky	5	10	6	21
Anabarsky	7	3	1	11
Bulunsky	8	46	4	58
Eveno-Bytantaysky	17	23	3	43
Momsky	53	39	23	115
Nizhnekolymsky	27	85	13	125
Oleneksky	10	35	12	57
Srednekolymsky	4	22	4	30
Ust-Yansky	18	9	0	27
Verkhnekolymsky	8	17	19	44
Verkhoyansky	19	11	8	38
Zhigansky	3	5	3	11
Total for the arctic zone	193	334	107	634
Total for the Republic of Sakha (Yakutia)	1684	2001	329	4014
Share of telemedicine consultation in the arctic zones of the Republic of Sakha (Yakutia), %	11.5	16.7	32.5	15.8

In order to combat the coronavirus infection, regional authorities purchased personal protective equipment, test systems, medical equipment and medicines, launched the Hotline information service and the Medset application for remote monitoring of the health of self-isolated people, and increased home care as much as possible [2]. Remote prescriptions for basic therapy of chronic diseases were also introduced, and the media increased educational work on the prevention of COVID-19. Anti-epidemic measures were established in shift camps of industrial enterprises, workers underwent preliminary observation, double PCR testing and enzyme immunoassay for the presence of IgM and IgG antibodies. Weekly video conferences with employers were organized, and morbidity in these institutions was constantly monitored.

However, the high contagiousness of the infection, the peculiarities of local logistics, insufficiently effective control over compliance with all necessary safety measures, a large number of so-called shift camps, and most importantly, the underestimation by a significant part of the population of the danger of the new infection and, as a result, an irresponsible attitude to the isolation regime, contributed to the rapid spread of COVID-19 throughout the republic, especially in the Arctic zones of the Republic of Sakha (Yakutia), which at first created significant difficulties in the prompt organization of anti-epidemic measures, the deployment of hospitals and the provision of medicines.

To increase the existing bed capacity in the region, temporary hospitals and outpatient centers were opened on the territory of sports facilities and educational institutions, and a number of medical organizations in the region were repurposed. Of course, these forced measures had a negative impact on the state of healthcare in the region. Thus, in 2020, the hospitalization rate compared to 2019 decreased by 23.7%, the volume of inpatient care - by 24%, the intensity of use of beds in hospitals - by 14.8%. Mainly due to the increase in the number of infectious disease beds for adults (from

[1] Decree of the Head of the Republic of Sakha (Yakutia) «On the introduction of a high alert regime in the Republic of Sakha (Yakutia) and measures to counter the spread of a new coronavirus infection (COVID-19)» dated March 17, 2020 No. 1055.

[2] Resolution of the Chief State Sanitary Doctor of the Republic of Sakha (Yakutia) «On the introduction of restrictive measures (quarantine) for a new coronavirus infection in organizations with round-the-clock presence of people in the Republic of Sakha (Yakutia)» dated April 2, 2020 No.7.

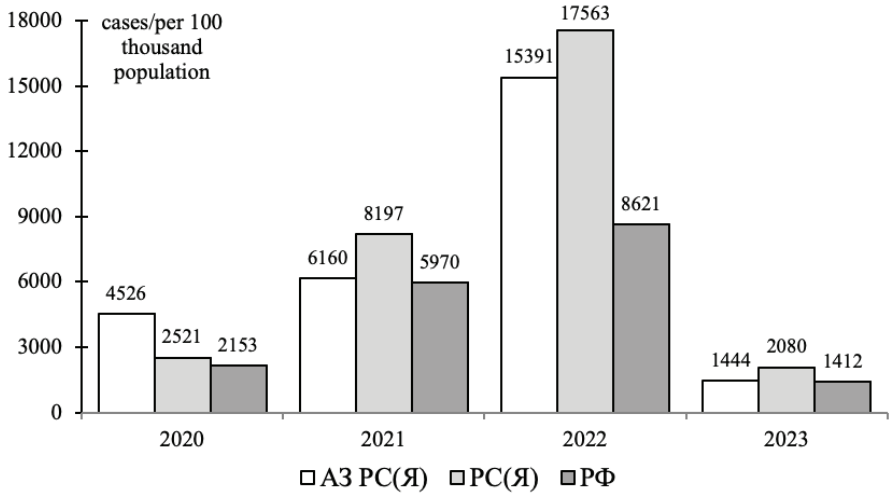
264 to 1691), the number of therapeutic (by 40.9%, or from 1377 to 814 units), tuberculosis (by 29.1%, or from 731 to 518 units), neurological (by 35.8%, or from 386 to 248 units), gynecological (by 35.6%, or from 388 to 250 units), pediatric somatic (by 34.9%, or from 708 to 461 units) decreased. This exacerbated the already complicated situation in healthcare, especially in remote districts [3].

Due to the lack of round-the-clock anesthesia posts in the Arctic zones of the Republic of Sakha (Yakutia) and the overload of the capital's hospitals, the Ministry of Health of the Republic of Sakha (Yakutia) opened inter-district infectious disease centers at large central regional hospitals. Thus, seriously ill patients from the Olenyok district were transported by ambulances to the Bulunsky district, residents of Western Yakutia - to the hospital in the city of Mirny. In a short time, the capacity of laboratories performing PCR diagnostics was significantly increased in the region - up to 4,000 tests were performed per day, which made it possible to identify patients in a timely manner.

In April 2020, a regional telemedicine center for consultations on issues related to coronavirus infection was created on the basis of the Yakut Republican Clinical Hospital by the faculty of the NEFU named after M.K. Ammosov. In the period from 2020 to 2022, specialists conducted more than 4 thousand telemedicine consultations, incl. 639 – for specialists of Arctic central regional hospitals (Table 1).

The first case of coronavirus infection in the Arctic zone of Yakutia was recorded in the Ust-Yansky district on May 5, 2020 (the patient was a demobilized soldier who arrived from the city of Khabarovsk), i.e. 48 days after the first case was recorded in the region. Later, cases of coronavirus infection began to be recorded in other districts of the Arctic zones of the Republic of Sakha (Yakutia). However, despite the relatively late appearance of the infection in the Yakut Arctic, in the first year of the pandemic, the incidence of COVID-19 in the Arctic zones of the Republic of Sakha (Yakutia) was at the level of 4526 cases / 100 thousand inhabitants, i.e. more than 2 times higher than the average in the Russian Federation and 1.8 times higher in the region (Figure). The total number of identified diagnoses of coronavirus infection was 3062 or 12.5% of the total number in Yakutia (Table 2). In subsequent years, namely in 2022 and 2023, the incidence rate continued to grow, but the share of the Arctic zones of the Republic of Sakha (Yakutia) decreased significantly.

According to the results of 2020, the



Incidence of COVID-19 in Yakutia and Russia

Table 2

Absolute number of COVID-19 cases in the Arctic zones of the Republic of Sakha (Yakutia)

District	Years				
	2020	2021	2022	2023	2020-2023
Abyisky	24	66	777	323	1190
Allaikhovsky	88	196	405	1	690
Anabarsky	334	29	262	56	681
Bulunsky	23	426	277	3	729
Eveno-Bytantaysky	408	262	326	17	1013
Momsky	324	640	1027	82	2073
Nizhnekolymsky	398	601	940	107	2046
Oleneksky	411	199	1062	16	1688
Srednekolymsky	274	285	403	14	976
Ust-Yansky	330	558	1065	33	1986
Verkhnekolymsky	161	361	1985	249	2756
Verkhoyansky	286	165	965	26	1442
Zhigansky	1	167	356	1	525
Total for the Arctic zones of Yakutia	3062	3955	9850	928	17795
Share of the total in Yakutia, %	12.5	5.0	5.7	4.5	6.0

share of the child population of the Sakha Republic (Yakutia) among all those infected with COVID-19 was 13.5%, in 2021 the number of infected children increased to 19.6%. The incidence of COVID-19 among children (under 17 years old) by the districts of the Arctic zones of the Sakha Republic (Yakutia) is presented in Table 3. The territorial features of the Yakut Arctic contributed to a gradual increase in the number of infected children in the study area, in 2021, 851 children fell ill, in 2022 - 3761, which amounted to 7.8% of the total number of infected children in Yakutia.

In 2019-2023, only 211 people died from COVID-19 in the Arctic zones, which amounted to 6.2% of the total number of deaths from coronavirus infection in Yakutia for this period (Table 4). The largest number of deaths was observed in the Verkhoyansky (n = 39) and Zhigansky (n = 31) districts. A significant number of deaths in 2021 (124 people) is associated with the circulation of the Delta strain in the population, which is characterized by a more severe course.

The rapid response system should be based on the qualifications of medical workers with a high level of theoretical and practical training in infectious diseases. In order to prevent a significant burden on the healthcare system, it is necessary to strengthen the equipment of even remote medical institutions with modern equipment for early diagnostics, including the ability to conduct PCR diagnostics.

Conclusion: The COVID-19 pandemic has become a serious challenge for

Table 3

Incidence of COVID-19 among children (under 17 years) by regions of the Arctic zones of the Republic of Sakha (Yakutia)

District	Years			
	2021		2022	
	n	per 100 thousand population	n	per 100 thousand population
Abyisky	11	1030.0	336	33038.3
Allaikhovsky	60	7528.2	214	27191.9
Anabarsky	6	476.6	23	1816.7
Bulunsky	69	3046.4	48	2087
Eveno-Bytantaysky	36	3833.9	76	8278.9
Momsky	105	3343.9	366	12461.7
Nizhnekolymsky	164	11365.2	258	17659.1
Oleneksky	53	3386.6	355	22511.1
Srednekolymsky	15	1204.8	199	16583.3
Ust-Yansky	195	12142.0	472	28365.4
Verkhnekolymsky	79	3207.5	855	35389.1
Verkhoyansky	28	1374.6	421	20496.6
Zhigansky	30	3246.8	138	15198.2
Total/on average* for the Arctic zone of Yakutia	851	4245.1*	3761	18544.4*
Share of the Arctic zone of Yakutia, %	5.5	-	7.8	-
total/on average* in Yakutia	15596	5895.4*	48230	18222.8*

Table 4

The number of deaths from COVID-19 and their share of the total number of deaths in the area

District	Years									
	2020		2021		2022		2023		2020-2023	
	n	%	n	%	n	%	n	%	n	%
Abyisky	3	4.9	14	21.9	3	5.0	0	0.0	20	8.5
Allaikhovsky	1	2.9	6	14.3	1	2.6	0	0.0	8	5.3
Anabarsky	3	6.5	3	8.1	1	3.8	0	0.0	7	5.0
Bulunsky	1	1.2	14	15.9	2	3.0	0	0.0	17	5.7
Eveno-Bytantaysky	3	5.6	3	5.8	0	0.0	0	0.0	6	2.8
Momsky	10	6.8	21	16.9	8	7.0	0	0.0	39	8.2
Nizhnekolymsky	9	13.8	21	31.8	1	2.4	0	0.0	31	14.3
Oleneksky	2	3.6	7	12.3	4	10.3	2	5.7	15	8.0
Srednekolymsky	1	1.7	8	12.9	1	2.5	0	0.0	10	4.9
Ust-Yansky	9	18.0	10	20.8	3	7.9	1	3.3	23	13.9
Verkhnekolymsky	1	1.0	14	14.1	7	8.1	0	0.0	22	6.2
Verkhoyansky	6	7.5	0	0.0	2	2.6	0	0.0	8	2.2
Zhigansky	1	3.3	3	8.1	1	3.2	0	0.0	5	4.1
Total	50	5.8	124	13.9	34	4.7	3	0.5	211	6.7

the healthcare system of the Republic of Sakha (Yakutia), especially in the Arctic regions, where extreme climatic conditions, poorly developed transport infrastructure and low population density have complicated the organization of medical care. Despite the prompt introduction of restrictive measures, the expansion of hospital beds, the creation of inter-district infectious disease centers and the active use of telemedicine, the spread of coronavirus infection in the first years of the pandemic in the Arctic zone of the Republic of Sakha (Yakutia) was more intense than the average for Russia and Yakutia.

An analysis of morbidity and mortality showed that the greatest difficulties arose in 2020-2021, which was associated with both the high contagiousness of the virus and objective logistical difficulties, insufficient equipment of remote medical institutions and low adherence of the population to preventive measures. However, by 2022-2023, thanks to the accumulated experience, increased laboratory diagnostics and optimization of patient routing, it was possible to reduce the burden on the healthcare system and reduce the share of Arctic regions in the overall morbidity structure.

The data obtained indicate the need for further development of healthcare infrastructure in hard-to-reach regions, including equipping medical institutions with equipment for early diagnosis, expanding telemedicine capabilities, and increasing the readiness of medical personnel to respond to epidemiological threats. In addition, it is extremely important to carry out more intensive preventive work among the population, especially among risk groups. The lessons of the COVID-19 pandemic should be taken into account when forming strategies for the prevention and control of future infectious diseases.

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N.A. Muldasheva, I.I. Zaydullin, D.O. Karimov, L.K. Karimova, I.V. Shapoval, Z.F. Gimaeva

ASSESSMENT OF THE ROLE OF VARIOUS FACTORS IN THE FORMATION OF ARTERIAL HYPERTENSION IN CHEMICAL WORKERS BY A MACHINE TRAINING METHOD

The article discusses key cardiovascular risk factors hypertension in workers of chemical industries. The study aims to identify the contributing factors using machine learning methods.

Materials and methods. The study involved 643 male workers, including 551 operators from two chemical production facilities (Ethylene-Propylene and Ethylbenzene-Styrene plants) and 92 automation center workers. The evaluation of production and non-production risk factors was conducted through periodic medical exams, consultations with cardiologists, and assessments of stress and depression levels. A gradient boosting method in the CatBoost library was used to analyze the data, considering both work-related and personal factors like age, smoking, anxiety, depression, and lipid profiles.

Results. The analysis showed that age, smoking, high LDL levels, BMI, and years of work in harmful conditions were the most significant factors in predicting the development of AH. For the Ethylbenzene-Styrene (EBS) operators, the major factors influencing AH risk were work experience (23.78%), age (18.06%), and smoking (14.53%). For the Ethylene-Propylene (EP) operators, the key factors were work experience (20.59%), smoking (20.22%), and LDL levels (18.07%). Statistically significant differences in anxiety and stress levels were found between the EP and EBS groups ($p<0.05$).

Conclusion. The study concludes that both production-related and non-production factors contribute significantly to the risk of developing AH among workers in chemical industries. Key factors like smoking, BMI, and LDL levels, along with harmful occupational exposures and high emotional stress, should be addressed in preventive measures to reduce hypertension risks in this workforce.

Keywords: chemical industry, risk factors, machine learning, occupational stress.

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FBSI Ufa Research and Development Institute of Occupational Medicine and Human Ecology: **MULDASHEVA Nadezhda Alekseyevna** – researcher, https://orcid.org/0000-0002-3518-3519, muldasheva51@gmail.com; **ZAYDULLIN Iskander Ildarovich** – PhD, researcher, https://orcid.org/0000-0002-6031-5683, isderkan@yahoo.com; **KARIMOV Denis Olegovich** – PhD, head of the department, https://orcid.org/0000-0003-0039-6757, karimovdo@gmail.com; **KARIMOVA Lilia Kazymovna** – MD, professor, https://orcid.org/0000-0002-9859-8260, iao_karimova@rambler.ru; **SHAPOVAL Inna Valerievna** – researcher, https://orcid.org/0000-02-3258-2477, shapoval-inna@mail.ru; **GIMAEVA Zulfiya Fedayevna** – MD, researcher, https://orcid.org/00000001-6668-2196, gzbiológicas33@mail.ru.

Introduction. Research conducted in recent decades has allowed for the identification of key risk factors for the development of cardiovascular diseases (CVD), the study of their interrelationship, and the formulation of the concept of overall cardiovascular risk [1].

It has been established that the main risk factors include hypertension (HT), dyslipidemia, excess body weight (BMI), obesity, diabetes, hyperuricemia, thrombogenic factors, and inflammatory factors [4]. It is important to note that ecology, the social environment, and lifestyle also have a significant impact on the development of CVD. The interaction of these factors with genetic and gender characteristics can contribute to the progression of cardiovascular diseases [15].

Low educational levels, lack of social support, psychosocial stress, as well as anxiety and depressive disorders in the working-age population also play an important role in the development of CVD, as confirmed by the results of numerous epidemiological studies [11,14,5]. Smoking is one of the most significant clinical risk factors for CVD [3,8].