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# Current issues in ensuring the sanitary and epidemiological well-being of the Russian Arctic population

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**Abstract.** The Social Hygienic Monitoring (SGM), being the tools to ensure the sanitary and epidemiological well-being, currently does not allow to fully identify the causal relationships of environmental factors and public health. There are imperfections in the organization and conduct of the SGM, which are characteristic both in the whole country and specifically in the territories of the Russian Arctic. The researchers of North-West Public Health Research Center (NWPHRC) assessed the sanitary and epidemiological situation of the Russian Arctic for 11 years using GIS and spatial analysis methods, which simplified the identification of territories and risk indicators, as well as management decisions. At present, research work is being conducted on the creation and development of a geoportal of sanitary and epidemiological well-being in the Russian Arctic using GIS technologies and space (remote) sensing tools. The SGM currently needs to be improved. It is necessary to develop it at the interregional level using modern methods of collecting, analyzing, processing, evaluating and visualizing indicators of the sanitary and epidemiological well-being in the Russian Arctic. The authors formulated the objectives that need to be addressed in the field of sanitary and epidemiological well-being in the Russian Arctic.

## 1. Introduction

In recent years, there has been a stabilization of the main indicators characterizing the sanitary-epidemiological situation in the Russian Federation. The Rospotrebnadzor's steps have played an important role in this [1].

One of the main strategic government objectives for the sustainable development of Russian Arctic is demographic processes stabilization, increase the effectiveness of measures to preserve and improve the health of the population, including most vulnerable indigenous groups.

However, despite state objectives and efforts to develop legal acts in the Russian Arctic, the Russian Arctic problems are being solved too slowly and ineffectively.

We can identify the following factors that cause a decrease in immunity in the population of the Russian Arctic: a violation of daylight hours, low temperatures, low-mineralized drinking water and dietary habits. Violations of the sanitary and epidemiological rules of the organization of work and life also significantly affect the health of the inhabitants of the Russian North.

The indigenous population has specific physiological adaptation mechanisms to the extreme conditions of the North, however, workers who come even for a short time are exposed to the negative effects of climate, which negatively affects their health and productivity.



This means the need to develop evidence-based management solutions by Rospotrebnadzor to ensure the sanitary and epidemiological well-being of the indigenous and the nonresidents population of the Arctic, which is not adapted to the conditions of the North, taking into account the above features and problems.

## **2. Objectives**

Prepare proposals for improving the sanitary and epidemiological well-being of the population of the Russian Arctic by the analysis of legislation and environmental factors and public health.

## **3. Material and methods**

Laws and regulations governing relations in sanitary and epidemiological well-being of the population field. The data of federal forms of statistical observation of the state of public health, medico-demographic and socio-economic indicators, and the results of socio-hygienic monitoring were used. The methods of scientific hypothetical and deductive analysis, general logical methods and techniques of research are used: analysis, synthesis, abstraction, generalization, induction.

## **4. Results**

It is necessary to have complete, reliable and high-quality information in the field of «environment – public health» for sanitary-epidemiological and public health risk assessment and for the prevention of morbidity in Russian Arctic.

The SGM, as one of the tools to ensure sanitary and epidemiological well-being, is a system for collecting, processing and analyzing data on habitat parameters, socio-economic indicators of the population and medico-demographic characteristics [2]. For more than 20 years, SGM has developed into a powerful information system. A federal information fund of the SGM (FIF SGM) was created, which is a unique base for promising scientific developments, rule-making and management of sanitary and epidemiological well-being.

However, the SGM task to create an effective mechanism for determining cause-effect relationships is not fully implemented, and in the field of its organization and management there are a number of shortcomings for the whole country and for the Russian Arctic territories.

Methods for selecting control points and forming a list of indicators of environmental pollution for the purposes of SGM, as well as a methodology for assessing the social and economic efficiency of SGM, have not been sufficiently developed. The low quality of information analysis, health risk assessment and prediction of the situation reduces the effectiveness of the preventive activity of the Rospotrebnadzor. All this does not allow for a qualitative reasoning of managerial decisions aimed at ensuring sanitary and epidemiological well-being.

The SGM system has a strong territorial division, however, a full-fledged and objective understanding of the state of the environment can be formed taking into account data collected in several territories bordering each other, including those belonging to different constituent entities of the Russian Federation [3].

There are other problems in the Russian Arctic: low population density, the predominance of small settlements without high-quality medical care and problems of statistical accounting of morbidity. There are also problems in modern communication systems, there are no measurement and sampling devices adapted for low temperatures for laboratory research.

In 2017 the researchers of NWPHRC conducted a sanitary and epidemiological situation assessment of the Russian Arctic for 11 years. The official statistical data, FIF FGM materials, research results in the field of public health and environmental factors were used. GIS and spatial analysis methods were used, which made it possible to simplify the identification of problem areas and risk indicators necessary for making management decisions [4].

Currently research is being conducted on the creation and development of an electronic atlas of sanitary and epidemiological well-being in Russian Arctic with the use of GIS technologies and means of space sensing.

The research showed the complexity of the situation in sanitary and epidemiological well-being. The research showed the complexity of the situation in sanitary and epidemiological well-being and made it possible to identify the most significant problems:

- demographic problems;
- infectious and parasitic morbidity;
- the air quality;
- the drinking water quality.

Some regions are characterized by a decrease in population: the Murmansk region, the arctic territories of the Republic of Sakha (Yakutia) and the Arkhangelsk region.

Medical and demographic indicators in the Russian Arctic are characterized by a decrease in the total (10.1 to 9.3 per 1000 population) and infant (from 10.9 to 6.7 per 1000 live births) mortality rates, an increase in life expectancy. At the same time, there is an increase in mortality from malignant neoplasms (from 1.25 to 1.45 per 1000 population).

The lowest rates of life expectancy are found in the Chukotka Autonomous District (64.42 years), with the average life expectancy of 45 to 50 years for men in the Chukotka countryside in recent years. The region also has the highest infant mortality rates. The territories with the risk of total mortality are the Arkhangelsk and Murmansk regions, the Republic of Sakha (Yakutia) and the Chukotka Autonomous District. In addition, the Arkhangelsk and Murmansk regions are risk areas for mortality from malignant neoplasms.

The total non-infectious incidence for 11 years has changed little, but this indicator in the Russian Arctic is 1.4 times higher than in Russia as a whole (109057.5 per 100,000 population). This is typical for all Russian Arctic districts, except for Primorsky (Arkhangelsk region), Turukhansk (Krasnoyarsk region), Chaunsky (Chukotka autonomous district) and Anabarsky (Republic of Sakha (Yakutia)) districts.

The incidence of congenital anomalies (malformations) of children in the Russian Arctic is 1.5 times higher than the average Russian indicators (1,624.1 per 100,000 population aged 0 to 14 years). The highest levels are found in the Nenets and Yamalo-Nenets autonomous districts, the Arkhangelsk region and the city of Vorkuta.

Over the past 11 years, the incidence of malignant neoplasms tends to increase, with the risk areas being Murmansk and the Arctic territories of the Arkhangelsk region.

Another problem of the Russian Arctic is the incidence of active forms of tuberculosis and viral hepatitis A, B and C. The territories of risk are the Chukotka autonomous districts, the Republic of Sakha (Yakutia), the Krasnoyarsk region, the Yamalo-Nenets autonomous districts, the city of Vorkuta.

It should be noted that, in general, a decrease in the incidence of active tuberculosis is observed in the Russian Arctic, however, in the Chukotka autonomous district there is a pronounced upward trend. Among parasitic diseases, opisthorchiasis and diphyllobotriasis are most common. There is a tendency to reduce the incidence of these parasitosis in the whole of the Russian Arctic. The highest incidence is observed in the following regions: opisthorchiasis in the Yamalo-Nenets autonomous district and the city of Vorkuta, diphyllobothriasis in the Republic of Sakha (Yakutia), the Nenets autonomous district and Krasnoyarsk region.

At the same time, according to some authors, the actual incidence of parasitosis can be significantly higher, as indicated by the results of selective studies of indigenous groups [5].

The air quality in Russian Arctic is a problem in industrialized areas: the city of Vorkuta, the city of Norilsk, the city of Murmansk region and the Yamalo-Nenets autonomous district, where hygienic limits were exceeded. The main sources of emissions to the atmosphere are industrial enterprises: mining, fuel and energy companies, metallurgical, chemical, pulp and paper companies.

Another problem of the Russian Arctic is the provision of the population with centralized water supply. For most regions, the organization of centralized water supply is an extremely difficult task due to the large distances and the presence of permafrost. These regions include the Chukotka and Nenets autonomous districts and the Republic of Sakha (Yakutia). For example, in the Bulunsky and

Ust-Yansky districts of the Sakha Republic (Yakutia) less than 55% of the population are provided with centralized water supply, and in the Anabarsky district of the Sakha Republic (Yakutia) and the Shuryshkarsky district (Yamalo-Nenets autonomous district) there is no centralized water supply at all.

The share of water samples from the distribution network of centralized drinking water supply with excess of sanitary and chemical hygienic limits in the Russian Arctic is almost 2 times higher (25.1%) than the average Russian indicator. In the distribution network of settlements in the Arctic regions of the Krasnoyarsk region, the Republic of Sakha (Yakutia) and the Chukotka autonomous district, more than 30.0% of drinking water samples did not meet hygienic limits.

The distribution network water quality in terms of microbiological indicators in the Russian Arctic in general does not differ from the average in Russia. However, in the Arctic regions of the Republic of Sakha (Yakutia), the share of samples with excess of hygienic microbiological limits in 2017 amounted to 22.4%.

## 5. Discussion

An important basis for the «reformatting» of the SGM is the emergence of new methods of control and supervisory activities by Rospotrebnadzor, as well as the transition to a risk-oriented planning model. In 2017, the SGM was legally referred to control measures, during which no interaction of state and municipal control bodies with legal entities and individual entrepreneurs is required.

The methods of the SGM at the regional level can be used in the planning and realization of government control by Rospotrebnadzor measures in relation to a specific object of control.

For example, laboratory and instrumental monitoring of the manufacturing process (including quality control and product safety, working environment, waste, emissions of harmful substances into the air, etc.) should be organized taking into account control tasks and analytical tasks of the SGM.

The collection of this information is necessary to assess the impact of the enterprise's activity on the health of workers and the affected population in order to establish cause-effect relationships in the «object of supervision-public health» system. This information collection is necessary to assess the impact of the enterprise's activity on the health of workers and the exposure population in order to study cause-effect relationships in the «health population - monitoring facility» system.

Thus, the mutual integration of the SGM and the control and supervisory activities of Rospotrebnadzor becomes current. In this case, the results of one activity can be used in another and serve as a basis for work planning. Each system will continue to solve independent, unique tasks [6].

In our opinion, one of the promising directions for the further development of the SGM is creating a system of interregional social and hygienic monitoring. The main objective is to improve the SGM data analysis quality, taking into account factors affecting the health of the population and having an interregional pattern: climatic factors, pollution transfer with atmospheric air, water of open reservoirs, etc.

As a result, it will be possible to determine the «special» points of environmental factors control that will allow analyzing the state of the environment and public health not only in the territory of a single subject, but also in the Arctic region as a whole, formulate hypotheses about cause-effect.

The results of research carried out by the NWPHRC together with foreign scientists, with the study of the influence of specific factors of the North on public health and the environment, make it possible to create an inter-regional system of the SGM in the Russian Arctic. In the future, this will allow identifying priority health risk factors and making proposals for improving legal regulation, through the development of regulatory legal acts in the area of ensuring the sanitary and epidemiological well-being in the Russian Arctic.

## 6. Conclusion

Analysis of the results and objective problems in assessing causal relationships in the «environment – population health» system related to the existing methods that are not adapted for the Russian Arctic

conditions, allows us to formulate the following tasks for sanitary and epidemiological well-being ensuring:

- Development and justification of SGM organization and maintenance principles in the Russian Arctic, including an interregional one that takes into account the specific characteristics of the region.
- Development of actions set for early detection and countering threats related to the transboundary biological transport of highly toxic substances and dangerous infections in the Russian Arctic. Proposals to improve the legal regulation for the chemical and biological safety of the population.
- Functional improvement of the SGM with the inclusion of biomonitoring in it, which will allow moving from mathematical modeling of risk assessment to objective evidence of causal links between the harmful effects of environmental factors and human health disorders, implementing the principles of evidence-based medicine.
- Hygienic limits modification taking into account the low self-cleaning potential of environmental objects in the Russian Arctic and others.

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