DOI: 10.35595/2414-9179-2021-4-27-307-319

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DETERMINATION OF THE LEVEL OF REGIONAL MORBIDITY OF THE POPULATION BASED ON DATA ON ANTHROPOGENIC LOAD

ABSTRACT

The aim of the work is to determine the external, anthropogenic environmental factors that negatively affect the morbidity of the population and associated nosologies. The knowledge gained in this area will allow us to identify the adverse impacts of man-made nature and identify tools for environmental quality management to promote public health. Geoinformation data will help to identify the areas with the most intense environmental situation in the Murmansk region. It will also identify the dominant diseases in these areas.

Mining and metallurgical enterprises mainly contribute to the pollution of the territory of the region: Kola MMC, Severonikel, Phosagro, Kovdor mining and processing plant, North-Western Phosphorus Company, Olkon and Rusal, as well as the nuclear fleet and fish processing enterprises, power supply facilities. The air basin is dominated by fluoride compounds, which are the emissions of ethylene into the atmosphere.

Data on the demographic situation and medical statistics, including data on general morbidity and mortality, were obtained from the Territorial Body of the Federal State Statistics for Murmansk Region, Ministry of Health of the Russian Federation, Department of Monitoring, Analysis and Strategic Development of Health Care, Federal State Budgetary Institution "Central Research Institute for the Organization and Informatization of Health Care" of Ministry of Health of the Russian Federation and Ministry of Natural Resources and Ecology of Murmansk Region.

The medical and environmental analysis of adverse factors in the regions of Murmansk region was carried out taking into account the environmentally dependent diseases of the adult population. The assessment of the morbidity of the population in the Murmansk region showed that several areas with a tense environmental situation are identified in the region. Diseases of the respiratory system, digestive system, genitourinary system, and musculoskeletal system are leading in the structure of overall morbidity.

KEYWORDS: public health, environmental diseases, morbidity, anthropogenic load.

INTRODUCTION

Murmansk region is considered to be one of the most industrially developed regions of the Arctic zone. The largest industries include energy, fishing and mining complexes. In the energy system of Murmansk region the first place is occupied by Kola Nuclear Power Plant (NPP), which accounts for 48.3% of all electricity generation. The second place with 43.8% is occupied by hydroelectric power plants (HPPs). The fishing industry is represented by mining and transport

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vessels of various types and classes, processing coastal enterprises, and port facilities[1].The mining complex of Murmansk Region includes the extraction and processing of ferrous and non-ferrous metal ores, industrial production of copper, nickel, cobalt, semi-finished precious metals, primary aluminium, and apatite concentrate. Murmansk region is the largest producer of nickel, providing up to 10% of all-Russian production of iron ore concentrate and 7% of refined copper, as well as the only Russian producer of apatite, nepheline and baddeleyite concentrates. Altogether, this has a huge technogenic impact on the health and morbidity of the population of the region. According to WHO, the quality of the environment accounts for about 15–25 % of the global burden of disease. The peculiarity of the region also lies in the fact that in addition to the technogenic impact, climatic and geographical factors have a significant impact on human health. Murmansk Region is almost entirely located beyond the Arctic Circle. As a result, the influence of natural factors can significantly increase the adverse effects of man-made impacts and vice versa. Over the past decade a large number of research results with different levels of evidence have been accumulated, indicating the negative impact of certain technogenic environmental factors on the health of the population [*Leonov,* 2014; *Movchan,* 2018; *Shevchuk,* 2017].

Finding out the cause-and-effect relationship between the technogenic impact and the structure of the morbidity of the population in a certain area is an extremely important task. The high level of industrialization of the Murmansk region creates sources of regional and local pollution of the environment, which contributes to the morbidity of the population in the region for certain classes of diseases. Thus, the average Russian level is significantly exceeded by classes of diseases: neoplasms, diseases of the endocrine system, eating disorders and metabolic disorders (including obesity, insulin-dependent diabetes mellitus), diseases of the musculoskeletal system, in the class of respiratory diseases-asthma, asthmatic status, in the class of diseases of the digestive system-stomach ulcer and duodenum.

MATERIALS AND METHODS

The analysis of the morbidity of the population was carried out by systematization and subsequent logical, structural and comparative analysis of official statistical data and documents: Russian Statistical Yearbook for 2010–2019[2,3,4], Murmansk region in figures for 2014–2019[5,6], State Report on the state of sanitary and epidemiological well-being of the population in the Russian Federation 2018–2019[7], Report on the state and Environmental Protection of the Murmansk Region 2015–2018[8,9,10] and so on.

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1 Murmansk Region Chamber of Commerce and Industryhttps://murmansk.tpprf.ru/ru/region/.

2 Russian statistical yearbook.2016: Statistical collection / Rosstat. M., 2016. 725 p. https://rosstat.gov.ru/folder/210/document/12994.

3 Russian statistical yearbook.2018: Statistical collection / Rosstat. M., 2018. 694 p. https://rosstat.gov.ru/folder/210/document/12994.

4 Russian statistical yearbook.2020: Statistical collection / Rosstat. M., 2020. 700 p. https://rosstat.gov.ru/folder/210/document/12994.

5 Murmansk Region in figures. Federal State Statistics Service, Territorial body of the Federal State Statistics Service for the Murmansk Region. Murmansk. 2019. 138 p. https://murmanskstat.gks.ru//

6 Murmansk Region in figures. Federal State Statistics Service, Territorial body of the Federal State Statistics Service for the Murmansk Region. Murmansk. 2020. 135 p. https://murmanskstat.gks.ru/

7 On the state of sanitary and epidemiological well-being of the population in the Russian Federation in 2018: State report. M.: Federal Service for Supervision of Consumer Rights Protection and Human Well-being. 2019. 254 p.

8 Report on the state and environmental protection of the Murmansk region. Murmansk, 2015–185 p. https://mpr.gov-murman.ru/

9 Report on the state and environmental protection of the Murmansk region. Murmansk, 2017. https:// mpr.gov-murman.ru/

10 Report on the state and environmental protection of the Murmansk region. Murmansk, 2018. 204 p. https:// mpr.gov-murman.ru/

For the analysis we used the main demographic indicators, population size, indicators of natural population movement, migration, and mortality. The information array contains information about the primary and general morbidity of the population by the main classes of diseases in the districts and localities of the Murmansk region. The research materials were obtained in the Territorial bodies of Federal State Statistics Service for Cities and Districts, regional health organizations (Department of Health of Murmansk Region). Information on the state of the environment (sanitary and hygienic assessment of the state of the atmosphere, surface water, soil, and vegetation), socio-economic conditions, demographic situation, as well as medical statistics (morbidity and mortality according to ICD) were evaluated.

RESULTS AND DISCUSSION

The main factors affecting the health status of the population of Murmansk region are:

1) complex natural and climatic conditions: sharp temperature changes and atmospheric pressure changes during the day; the presence of a long daylight during the Polar day and the absence of a light interval during the Polar night; pronounced cosmic and geomagnetic disturbances, instability of the geophysical situation - pronounced variability of the geomagnetic field; a peculiar micro-and macronutrient composition of water and soil, characterized by a lack of biologically active substances or a violation of their balance; insufficient oxygen saturation of the air;
2) demographic factor: the ratio of the young population and the older population is steadily changing in the direction of increasing the share of the latter;
3) sanitary and epidemiological factors: water supply of the population in some localities with drinking water from an open water source without proper water treatment, unsatisfactory technical condition of water supply networks, unfavorable microclimatic conditions at workplaces, in the premises of institutions (including educational) and enterprises, especially during the period of disconnected heating, insufficient and inadequate nutrition of students in schools, unfavorable working conditions at enterprises due to noise and vibration factors, the intensity of the labor process, the presence of carcinogenic factors in technological processes at work, unsatisfactory sanitary and hygienic condition of some residential buildings and premises;
4) social factors: a decrease in the income of the population, insufficient funding for measures to bring the environment in line with sanitary-epidemiological and environmental norms and rules, insufficient demand among the population for the principles of a healthy lifestyle. As a result of the above reasons, there is a deterioration in the quality of health.

According to the results of the population census, since 2010, there has been a tendency to decrease the number of permanent residents in Murmansk region from 795.4 thousand people in 2010, up to 741.4 thousand people in 2019 (Table 1). The main decline is due to the working-age population. Thus, since 2015, the share of the working-age population aged 20–24 years has significantly decreased from 6.1% (as a result) in 2015 to 5.2 % in 2019 and from 8.7% to 6.0% in 25–29 years, respectively [1,2,3,4].

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1 Murmansk Region in figures. Federal State Statistics Service, Territorial body of the Federal State Statistics Service for the Murmansk Region. Murmansk. 2020. 135 p. https://murmanskstat.gks.ru/

2 Russian statistical yearbook. 2016: Statistical collection. Rosstat. M., 2016. 725 p. https://rosstat.gov.ru/folder/210/document/12994.

3 Russian statistical yearbook. 2018: Statistical collection. Rosstat. M., 2018. 694 p. https://rosstat.gov.ru/folder/210/document/12994.

4 Russian statistical yearbook. 2020: Statistical collection / Rosstat. M., 2020. 700 p. https://rosstat.gov.ru/folder/210/document/12994.

The determining factor in the decline in the population in the region is the migration decline, which amounted to 4.9 thousand people in 2019, and the migration growth rate per 10,000 people of the population is 6.5 permille. The dynamics of the migration of the population is shown in Figure 2. The second factor in the population decline is the increase in the natural population decline from -0.3 in 2016 to – 2.4 per mille in 2019.

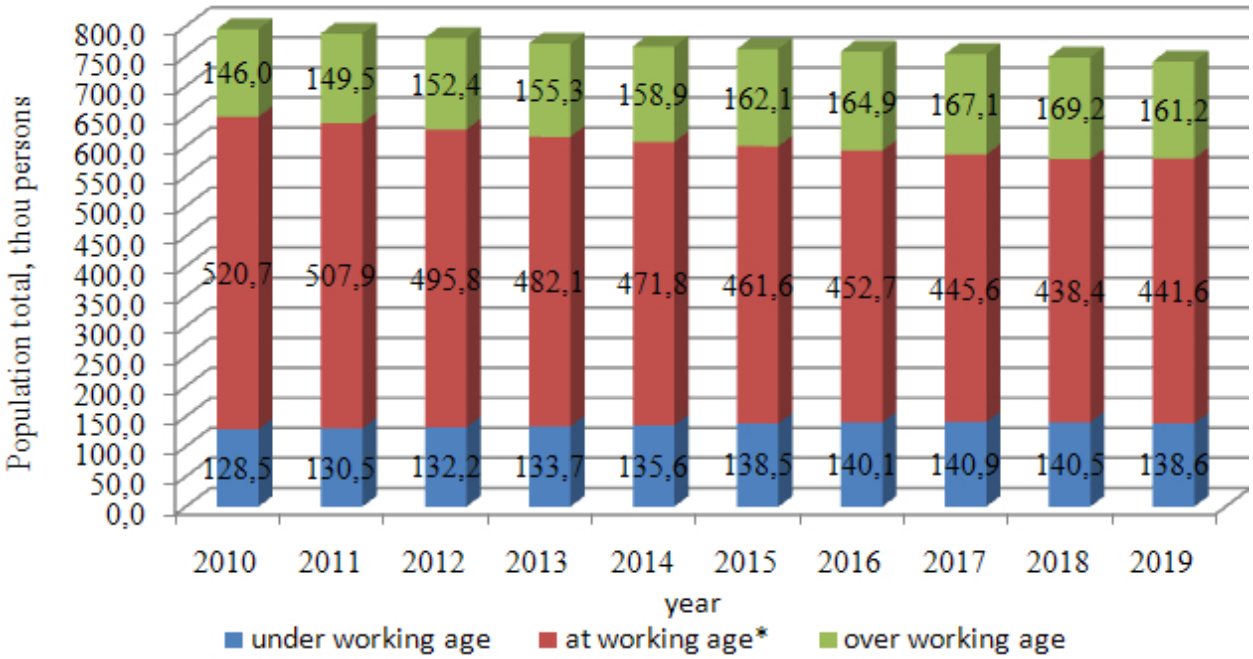

Fig. 1. Main demographic indicators estimate at the end of the relevant year
** - Malesaged 16 – 60 years, femalesaged 16 – 55 years*

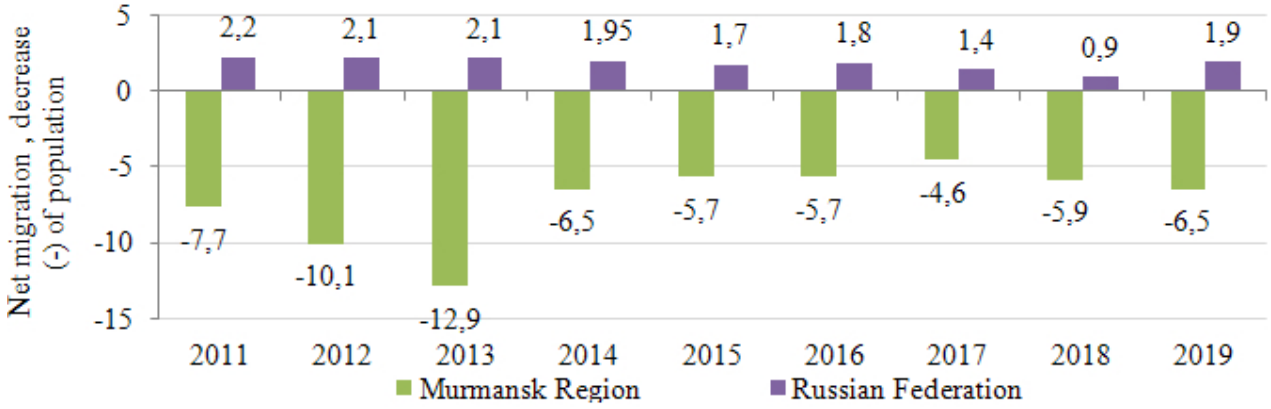

Fig. 2. Dynamics of the migration movement of the population. Migration growth per 1000 population

One of the main indicators of population health is life expectancy at birth. Life expectancy at birth for 2019 (average life expectancy) in Murmansk Region in comparison with regional (Murmanskstat) and federal indicators are presented in Table 1.

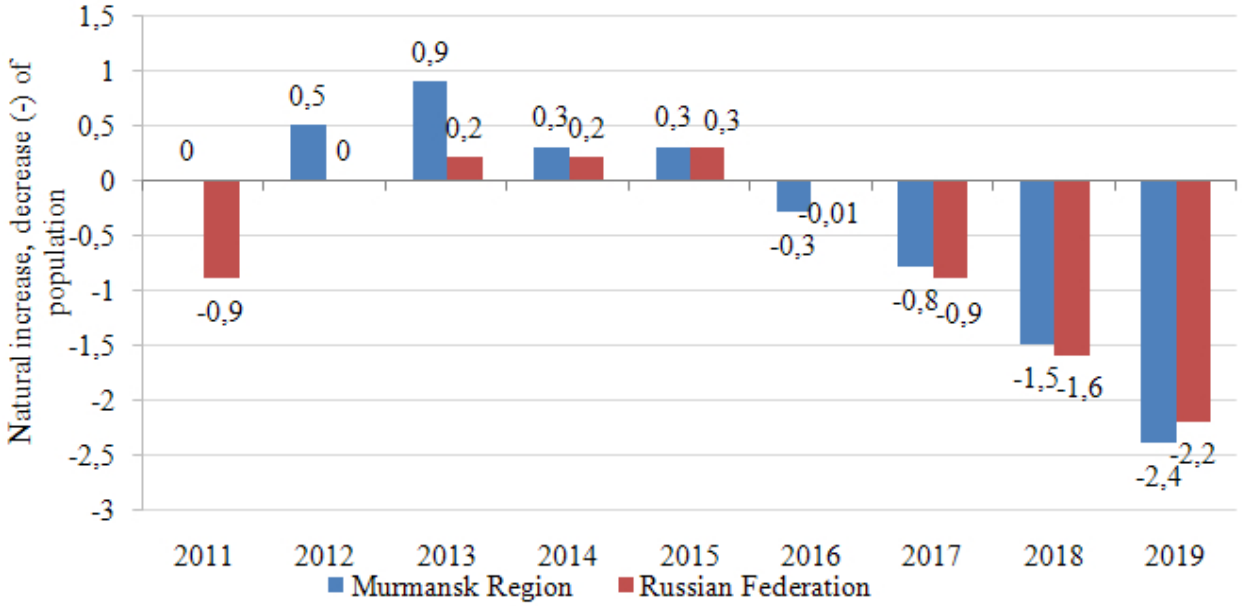

Fig. 3. Dynamics natural increase, decrease (-) of population.

Table 1. Life expectancy at birth, years

Year	Region	Total population	Males	Females
2015	Murmansk Region	70,2	64,5	75,7
	Russian Federation*	71,4	65,9	76,2
2016	Murmansk Region	70,9	64,6	74,7
	Russian Federation*	71,9	66,5	77,1
2017	Murmansk Region	71,7	66,4	76,6
	Russian Federation*	72,7	67,5	77,6
2018	Murmansk Region	70,9	67,5	75,6
	Russian Federation*	72,9	67,7	77,8
2019	Murmansk Region	71,8	66,5	76,6
	Russian Federation*	73,1	68,2	78,2

**- low forecast*

The priority risk factors that make the main contribution to the additional morbidity and mortality associated with environmental factors include permanent and multicomponent pollution of atmospheric air, drinking water, and soil of residential areas[1]. The main sources of environmental pollution in the Murmansk Region are mining and construction enterprises, nuclear fleet and fish processing enterprises, and power supply facilities.

[1] State report "On the state of sanitary and epidemiological welfare of the population in the Russian Federation in 2017. "https://www.rospotrebnadzor.ru/documents/documents.php.

The main enterprises of the mining and metallurgical complex of JSC "Kola MMC" (PJSC MMC "Norilsk Nickel") – the leading production complex of the Murmansk region, creased one of the oldest enterprises-the Severonikel and Pechenganikel combines, is a single mining and metallurgical product extraction of sulfide copper-nickel ores and the production of non-ferrous metals. The Kirovsk branch of JSC "Apatit" (PJSC "PhosAgro") produces and processes apatite-nepheline ores from the Khibiny deposits, which are among the largest and richest deposits in the world and are the base of phosphorus-containing raw materials in Russia[1]. It is also engaged in the production of apatite and nepheline concentrates and other mineral concentrates. JSC "Kovdor mining and processing plant" (JSC "MHC "EuroChem") develops the Kovdorskoye field and produces iron ore, apatite and baddeleyite concentrates. JSC "North-West Phosphorus Company" (PJSC "Acron") is developing the field of apatite-nepheline ores "OleniyRuchey" as part of the project to create a new phosphate raw material base in the Murmansk region. JSC "Olkon" (PJSC "Severstal") produces ferrous quartzite, produces and sells high-quality iron ore concentrate. The branch of JSC "RUSAL Ural" in Kandalaksha "OKRUSAL KAZ" (OK "RUSAL") produces aluminium from imported alumnium.

The main enterprise in the construction sector: LLC NOVATEK-Murmansk (a subsidiary of PJSC NOVATEK) is implementing the investment project "Center for the Construction of Large-capacity Marine Structures (CCLMS) in the village of Belokamenka, Murmansk region" on the western shore of the Kola Bay. TSKMS is designed for the manufacture of offshore complexes for the production, storage and shipment of liquefied natural gas and stable gas condensate on gravity-type bases, offshore production complexes, as well as repair and maintenance of marine equipment and equipment used for the development of offshore oil and gas condensate fields.

Murmansk Sea Fishing Port (hereinafter – MSFP) is the largest fishing port in the North of the Russian Federation. The fish terminal consists of three cargo areas, covers an area of more than 160 hectares. The total length of the mooring front exceeds 4 km, the length of railway tracks-30 km, crane tracks-3 km. FSUE "Atomflot".

Energy: Kola NPP accounts for 48.3% of all electricity generation, 43.8% for hydroelectric power plants, 7.8% for thermal power plants and 0.03% for thermal power plants.

To identify the impact of the environment on the health of the population, the most reliable diseases are those that depend on the state of the environment: Neoplasms (C00-D49), Diseases of the blood and hematopoietic organs and certain disorders associated with the immune mechanism (D50-D89); Endocrine, nutritional and metabolic diseases (E00-E89); Diseases of the nervous system (G00-G99); Diseases of the circulatory system (I00-I99); Diseases of the respiratory system (J00-J99); Diseases of the digestive system (K00-K95); Diseases of the skin and subcutaneous tissue (L00-L99); Diseases of the musculoskeletal system and connective tissue (M00-M99); Diseases of the genitourinary system (N00-N99); Congenital malformations, deformities and chromosomal abnormalities (Q00-Q99) (Table 2).

During the selected observation period, the overall morbidity rate in Murmansk Region exceeded the national average by an average of 1.1 times. One of the main markers of environmental problems in the external environment is respiratory diseases, which also exceed the national average values. The results of numerous Russian and foreign epidemiological studies objectively reflect the steady increase in the prevalence of allergic pathology in industrial cities, especially bronchial asthma [*Chernyak,* 2017; *Li,* 2003, *Guarnieri,* 2014]. The incidence of bronchial asthma in the Murmansk region exceeds the national average by 1.3 times.

[1] Passport of the Murmansk region on the website of the Ministry of Foreign Affairs, https://www.mid.ru/ru/maps/ru/ru-mur/-/asset_publisher/Qy2xQVB5Pyts/content/id/2836740).

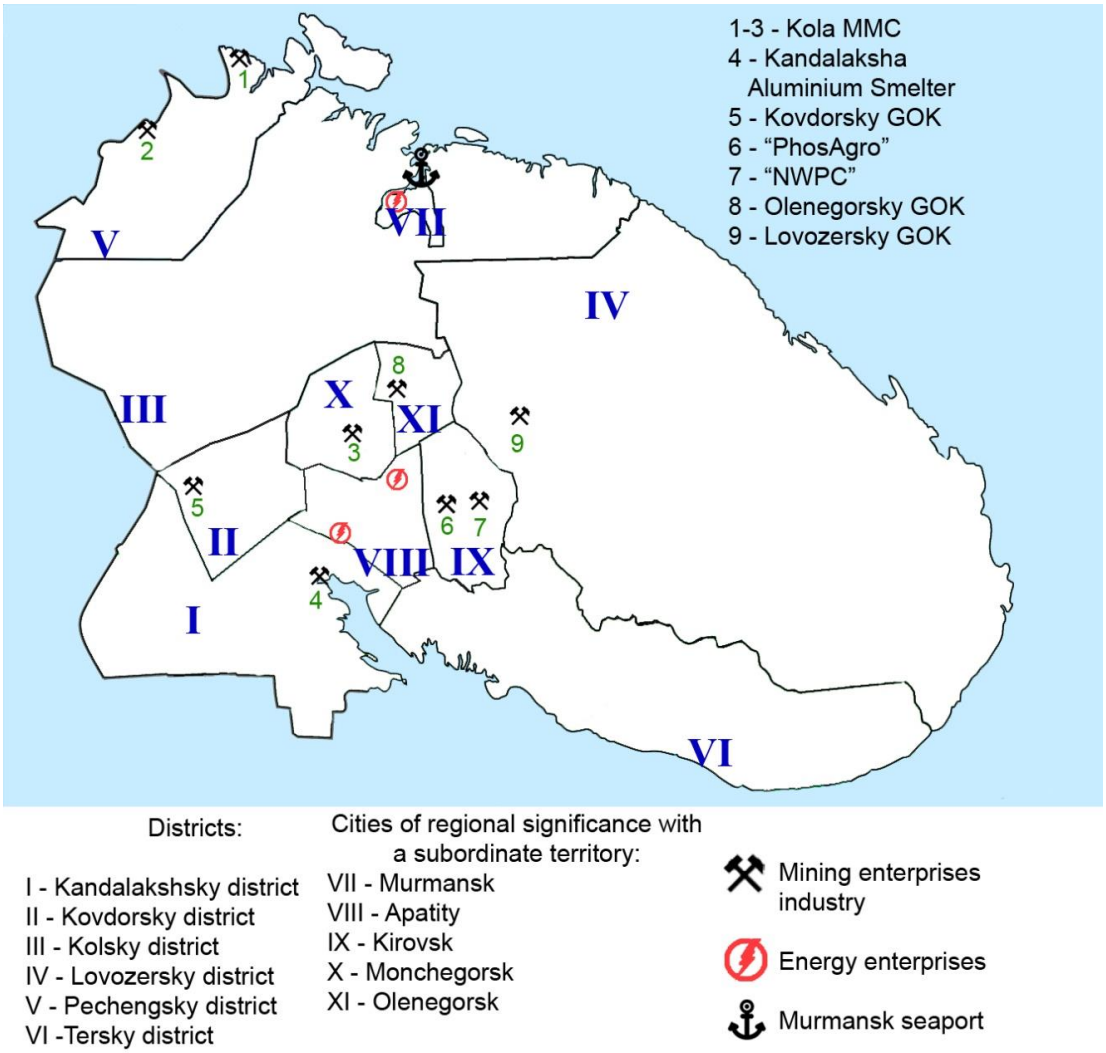

Fig. 4. Map of the main stationary sources of environmental pollution

Table 2. Morbidity by main classes newly diagnosed patients, per 1000 population

	2014		2015		2016		2017		2018		2019	
	Murmansk Region	Russian Federation	Murmansk Region	Russian Federation	Murmansk Region	Russian Federation	Murmansk Region	Russian Federation	Murmansk Region	RussianFederation	Murmansk Region	Russian Federation
All diseases	850,3	787,1	835,5	778,2	875,8	785,3	825,3	778,9	831,9	782,1	823,1	780,2
of them:												
C00-D49	17,2	11,6	17,3	11,4	15,3	11,4	14,3	11,4	19,1	11,6	13,1	11,9
D50-D89	2,9	4,7	3,3	4,7	3,0	4,7	3,2	4,5	2,8	4,3	3,1	4,2
E00-E89	14,7	11,2	18,6	13,3	17,8	13,9	16,8	14,0	15,6	13,1	16,7	14,4
G00-G99	12,7	16,2	12,6	15,4	12,9	15,2	13,6	15,0	13,9	14,8	15,2	14,8
I00-I99	22,6	28,8	22,7	31,2	22,5	31,7	20,4	32,1	18,0	32,6	21,1	35,0
J00-J99	376,2	333,4	376,5	337,9	423,2	351,6	381,7	353,5	405,5	369,8	393,4	356,2
K00-K95	35,8	36,6	34,0	35,3	32,8	35,6	27,3	34,0	25,7	33,1	28,2	32
L00-L99	55,5	46,3	51,2	44,0	48,5	42,6	43,7	41,0	44,2	40,3	49,7	40,7
M00-M99	36,7	31,8	35,6	30,1	33,3	29,5	33,6	29,5	29,8	29,8	28,4	30,3
N00-N99	54,7	49	60,1	46,4	53	45,6	62,4	44,8	63,4	44,8	62,5	44,5
Q00-Q99	0,7	2,1	0,6	2,0	0,7	2,1	1,0	2,0	0,9	2,0	0,8	2,0

According to the analysis of the state of sanitary and epidemiological well-being of the population in the Russian Federation in 2018, 58.0% of the operated water pipes in the Murmansk Region did not meet the requirements of sanitary legislation[1]. The share of drinking water samples in the same year from the distribution network of centralized drinking water supply with an excess of hygienic standards for sanitary and chemical indicators exceeded the national average by 1.1–1.4 times. This is reflected in the incidence of the genitourinary, musculoskeletal and endocrine systems. So, in 2018, diseases of the genitourinary system were 1.4 times higher than the national average, diseases of the endocrine system were 1.3 times higher, and diseases of the skin and subcutaneous tissue were 1.1 times higher. Contamination of drinking water with chlorine and organochlorine compounds, ammonia and ammonium ion, iron, manganese, arsenic, nickel, and copper compounds, as well as microbiological contamination of water. Contribute to the formation of additional cases of morbidity associated with unsatisfactory water quality of the centralized drinking water supply system.

Among other nosologies, the excess was found for the entire period of observations for neoplasms by an average of 1.4 times compared to the average values for the Russian Federation (RF).

The average Russian level of soil contamination with chemicals in Murmansk region was more than 3 times higher (23.4 % of soil samples that do not meet the hygienic standards for sanitary and chemical indicators). Microbiological contamination is a priority factor affecting the quality of the soils of the Russian Federation in general and residential areas in particular. More than 2 times the average Russian level of soil contamination with chemicals was exceeded by 22.2 % of samples that do not meet the hygienic standards in the residential area in terms of sanitary and chemical indicators.

According to various sources, the cooperative effects of natural and anthropogenic factors can directly affect the nature of the territorial morbidity of the population [*Belisheva,* 2014, 2019, 2017, 2011, 2020].

Based on the assessment of diseases associated with environmental factors, maps for 2016–2017 were formed for the districts of Murmansk region and cities of regional significance (Fig. 5). The analysis of the results obtained allowed us to group all districts and localities into three cohorts, depending on the level of morbidity in comparison with the average regional indicators. The group of districts with a high level of morbidity included the town of Apatity, Kandalaksha and Kola districts. The group with an average level of morbidity includes Murmansk, Kirovsk, Monchegorsk, Kovdor and Olenegorsk districts. And in the third group with a low level of morbidity – the town of Olenegorsk, Pechenga and Tersk districts.

The main sources of technogenic pollution in group 1 (high incidence) are enterprises for the extraction and processing of apatite-nepheline ores, aluminium smelting enterprises, and thermal power plants. A particular health hazard is the release of fluoride compounds into the environment, the source of which is these enterprises [*Donskikh,* 2013; *Kasikov,* 2017]. The main source of fluoride compounds is an aluminium plant, whose emissions contain a significant amount of pollutants: hydrogen fluoride, fluorides, resinous substances, polycyclic aromatic hydrocarbons, inorganic dust. Fluoride compounds are highly hazardous substances (hazard class 2) and pose a greater danger to the body than aluminium compounds (hazard class 4). Fluorine compounds are a group of specific substances whose presence in the atmospheric air can have a significant impact on human health. The main impact occurs through the integumentary tissues of the skin and mucous membranes. The toxic effect of fluoride on the human body, which is mainly inhaled as a result of man-made environmental pollution, is manifested in the incidence of respiratory tract

[1] On the state of sanitary and epidemiological welfare of the population in the Russian Federation in 2018: State report. M.: Federal Service for Supervision of Consumer Rights Protection and Human Well-being. 2019. 254 p

diseases [*Sjåheim,* 2007]. Regardless of the route of entry and/or the conditions of exposure, fluoride, entering the human body, has a toxic effect on a whole complex of organs and systems, including diseases of the skin, endocrine and musculoskeletal systems [*Donskikh,* 2013].

Along with chemical air pollution, dust particles from tailing dumps containing a wide range of heavy and rare-earth metals, as well as impurities of natural radionuclides, represent a special class of danger. Reflection of the influence, which is visible on the morbidity of the population of Apatity, falls into the zone of dusting from apatitonephelin tailings.

The main sources of technogenic pollution affecting the health of the population in group II (average morbidity) are also enterprises for the extraction and processing of apatite-nepheline ores, for the extraction of copper-nickel sulfide ores and the production of non-ferrous metals, iron ore and baddeleyite concentrates, the Kola NPP, as well as the nuclear navy. Another source that affects morbidity is natural ionizing radiation and the effects of nuclear tests, which is reflected in the incidence of neoplasms. In particular, data from studies conducted in 1990–1994. It was shown that the density of contamination of the soil cover (Bq / m3) with radionuclides in Murmansk Region was the highest in comparison with the pollution in the Komi Republic, in Nenets Autonomous District and Chukotka Autonomous District. It was shown that in the village of Krasnoshchelye (Lovozero district), the concentration of radon Rn in the air of residential premises and the atmospheric air was 38.0 (15.0–88.5) and 5.9 (3.0–10.0) Bq / m3, respectively, which ended in an effective dose resulting from inhalation of radon decay products of 3.1 mSv / year [*Miretsky,* 1999].

In the third group (low incidence), the main sources of pollution are mining and metallurgical products for the extraction of copper-nickel sulfide ores and the production of non-ferrous metals, the extraction of ferrous quartzite and the production of iron ore concentrate. According to Rosstat and Rosprirodnadzor, the air pollution in the Murmansk region is mainly caused by emissions from stationary sources of industrial enterprises. The main source of pollution in the Pechenga district is Kola MMC, which produces copper-nickel sulfide ores and non-ferrous metals (p. Nickel and the town of Zapolyarny). According to observations for the period from 2013–2017, the average annual concentration of sulfur dioxide is higher than the sanitary norm. In recent years, the average annual concentrations of sulfur dioxide in the atmospheric air of the settlements of Nickel and Zapolyarny have decreased. It is reflected in the decrease in the incidence of the population. Increased and high single-time concentrations were recorded mainly at NMU: north-easterly winds, calm, air stagnation caused by temperature inversions in the surface and elevated layers.

Although there are no industrial enterprises in the Tersk district, most of the territory of the Tersk district is characterized by a dose rate of gamma radiation of less than 6 microns/hour. Soil contamination with caesium-137 corresponds to the level of the global background. The radiation situation in the area is mainly caused by natural factors – the content of natural radioactive substances (U, Th, and K) contained in the soil. This is reflected in the morbidity of the population with diseases of the blood and hematopoietic organs. In the Tersk district, there are four sites with unfavourable natural factors of the radiation situation.

Three of them are located outside the area of active economic activity, the fourth covers the vicinity of the village of Umba. On the territory of the district, a significant number of springs with increased content of radioactive radon gas was also identified. The main source of pollution on the island of Umbozero is the runoff of mining enterprises and the quarry waters of the mine, which contain fluorides. These substances enter the water basin through the system of rivers and lakes. Based on the results of research conducted in 1999 pollution of the Loparitovy stream with fluorides in various periods of the year was recorded from 28 MPC in October to 108 MPC in August.

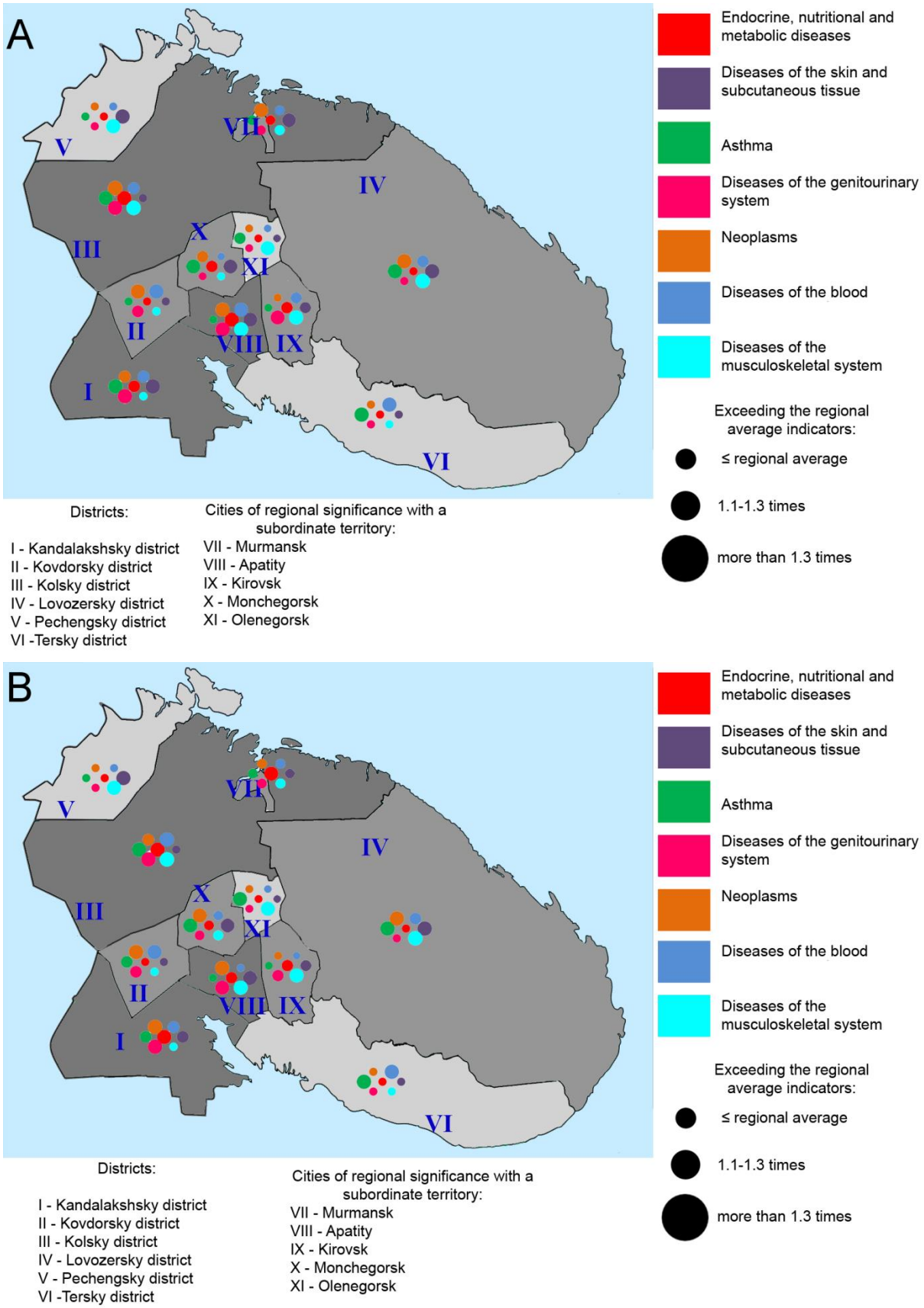

Fig. 5. The incidence of children (0−14 years) by the main classes of environmentally dependent diseases (A – 2016, B – 2017 years)

In the Umba River, the concentration of copper was 1–8 MPC, phenols-3–4 MPC; there was an excess of the maximum permissible concentration for the content of total iron, nickel, mercury and manganese[1].According to statistics for 2016–17, among the territories under consideration, the Tersky district ranks first in terms of low-quality drinking water. All this is reflected in the morbidity of the population.

An additional factor affecting the nature of pollution in the Murmansk Region may be interterritorial transfers of pollution caused by cyclonic activity. The direction of such transfers from sources of pollution can be traced based on a daily assessment of the content of various substances in the surface atmosphere[2].

In recent years, there has been a gradual decrease in the air pollution of settlements, improvement in the quality of drinking water and soil, as a result of which the total number of deaths and diseases of the population associated with environmental factors is decreasing (Table 3).

Table 3. Mortality by major causesof death (Per 100 000 population)

		Year	Russian Federation	North-Western Federal District	Murmansk region
Total deaths from all causes		2019	1228,1	1242,9	1133,1
		2018	1245,4	1261,4	1122,8
		2019 in to 2018 (%)	98,6	98,5	100,9
including from:	neoplasms	2019	201,5	236,7	199,8
		2018	200,1	230,9	200,1
		2019 in to 2018 (%)	100,7	102,5	99,9
	Including from malignantdiseases	2019	198,6	234,2	198,2
		2018	196,6	228,2	196,5
		2019 in to 2018 (%)	101,0	102,6	100,9
	diseases of the circulatory system	2019	573,7	650,1	596,3
		2018	579,6	670,8	601,8
		2019 in to 2018 (%)	99,0	96,9	99,1
	respiratory diseases	2019	39,5	36,8	20,3
		2018	41,0	38,8	21,0
		2019 in to 2018 (%)	96,3	94,8	96,7
	diseases of the digestive system	2019	66,4	71,0	77,1
		2018	64,2	65,5	64,1
		2019 in to 2018 (%)	103,4	108,4	120,3

1 Report of the State Committee for Environmental Protection of the Murmansk region "The state of the environment of the Murmansk region" 1999. http://www.murman.ru/ecology/comitet/report99/index.html.

2 A global map of wind, weather, and ocean conditions https://earth.nullschool.net.

CONCLUSION

Morbidity is an integral indicator of the quality of the environment. It also indirectly indicates the possible causality of certain nosological forms, which allows us to distinguish inter-territorial differences in the prevailing exogenous effects on the body of residents of the comparison territories. The economic development of the region, the increase in mining and processing of minerals contributes to the increased tension of the environmental situation.

The long-term migration declines of the population, mainly of working age, occurs against the background of exceeding the level of the general morbidity of the population of Murmansk region in comparison with the Russian average for a number of nosologies: diseases of the respiratory system, endocrine, genitourinary, musculoskeletal system, digestive organs and neoplasms.

The assessment of the environmental situation in Murmansk region showed that the most acute situation with environmentally dependent diseases is observed in the town of Apatity, Kandalaksha and Kola districts (the polluting factor is enterprises for the extraction and processing of apatite-nepheline ores, an aluminium smelting enterprise, and a thermal power plant). The average level of morbidity is observed in Murmansk, Kirovsk, Monchegorsk in Kovdor and Olenegorsk districts. (the polluting factor is the enterprises for the extraction and processing of apatite-nepheline ores, the extraction of copper-nickel sulfide ores and the production of non-ferrous metals, iron ore and baddeleyite concentrates, the Kola NPP, as well as the nuclear navy). A more favourable environmental situation and, in this regard, lower morbidity rates are observed in the town of Olenegorsk, Pechenga and Tersk districts (the polluting factor is mining and metallurgical products for the extraction of sulfide copper-nickel ores and the production of non-ferrous metals, for the extraction of ferrous quartzite and the production of iron ore concentrate).

At the same time, I would like to note that there are certainly positive aspects. For example, along with a decrease in mortality rates from various diseases associated with environmental exposure, life expectancy at birth in the region has a positive trend.

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