

MEDICAL AND ECOLOGICAL ISSUES OF HUMAN ADAPTATION TO CLIMATE CHANGE IN THE HIGH NORTH

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Abstract

Of particular concern to all social institutions of society are causing problems, formed due to the impact of global climate change on the planet as a whole, and in particular the Arctic regions, their bioecosociosphere, public health and the organization of health care and others. On the territory of the Arkhangelsk region and Nenets Autonomous District to extreme hydrometeorological conditions that directly or indirectly affect human health are severe frosts, heavy precipitation in the form of rain and snow, strong winds, flooding during high water. Global climate change is most significant is characterized by sharp temperature fluctuations (increase in mean annual air temperature in the circumpolar area in the past decade, almost twice the world average), increasing the number of dangerous weather events and degradation of permafrost.

The most pronounced negative effect on the impact of human and environmental nature has recurrent waves of heat and cold. In addition to the deterioration of the health of vulnerable groups with diseases of the cardiovascular and people respiratory systems are faced with the problem of the safety of food and the risk of acute intestinal infections. In addition, there is risk of changes in the local ecosystem due to the migration to the new northern territories carriers of infectious diseases. Villages with fragile means of communication in this regard are subject to the greatest risk.

In the process of life a person is forced to adapt to environmental conditions. Exposure to extreme natural phenomena on the health and quality of life of the population of the Far North should be considered in the development of health-environmental measures aimed at reducing the risks of climate factors.

Keywords: climate, weather, permafrost, the Far North, adaptation, disease, environmental safety

According to scientists global climate change can be the most significant impact on the territories of the Nordic countries. Global climate models predict a stronger warming effect over the entire Arctic region than any other region of the northern hemisphere. It is predicted that climate change will continue to have a significant impact on human health in the Arctic regions, including the Arkhangelsk Region and the Nenets Autonomous District, especially in those populations who live in remote from the major centers of population centers. During the XXI century, without exception, climate models give a warming climate on the whole territory of the Russian North. The greatest warming is expected in the winter, and it will grow to the north, reaching maximum values in the Arctic. In all scenarios, the surface air temperature rise across the Arkhangelsk region [15]. Similar projections indicated in other published sources. By the end of the twenty-first century, the temperature peaks that first century happened once in 20 years, the Canadian sector are likely to be 5-10 times more often, and in Siberia - in 3-7 times [6].

Climate change in the North of Russia in the last decade, characterized by rapid changes in temperature and atmospheric pressure, an increase in the number of severe weather events that impact on the health of a population. The negative effects of climate change manifested in the change of demographic and morbidity due to climate-sensitive diseases of infectious nature (growth of cardiovascular, psychic and other diseases) and infectious nature (zoonotic diseases, parasitic diseases and intestinal infections), as well as the growth of the potential risks from high levels UV radiation (cataracts, melanoma).

Actively discussing climatic influence on the state of public health indicators: disability, mortality and morbidity [1, 14, 19, 23-26, 28, 30, 31, 33]. An important marker of the state of population public

health is the level of disability in the population. Cardiovascular disease in the Arkhangelsk region produces 27.9% of all causes of working population' disability. Second-place ranking takes disability due to malignant neoplasms (13.4%); third owned by injuries (12.7%), the fourth - diseases of the musculoskeletal system (8.2%), the fifth - mental disorders (7.5%) and six - diseases of the nervous system (6.1%). The primary disability' structure of the working population of the Arkhangelsk region in groups dominated by people whose disability is determined II (47.9%). The proportion of people with disabilities Group III is 43.1%, I group - 9.0% [4].

A serious problem of contemporary Russia's demographic development and the northern regions in particular, is the high level of mortality from cardiovascular diseases, accidents, poisonings and injuries, as well as tumors. Mortality from diseases of the circulatory system in the Arkhangelsk region was 57.3% (845.4 per 100 thousand.), Accident - 14.45 (212.5 per 100 thousand.), and from neoplasms - 13.4% (198, 6 on 100 thousand). [3, 4]. The effects of global climate change on demographics ascertain scientists around the world. There is a clear relationship between chronic heart failure (morbidity and mortality) in a cohort study of South Australia and the warm winters and hot summers [22]. In the study conducted in Germany in the study of time-series study of the 10-year period, found an inverse relationship between ambient temperature and the total number of myocardial infarction and mortality of the cardiovascular system, it is shown that heat waves increase the daily death rate from cancer by 15% from cardiovascular disease - by 30%, deaths from respiratory diseases - by 61% [21, 33]. The research results obtained in the Czech Republic indicate that cold stress has the same effect on mortality in Central Europe as heat waves [27]. There are results of the integrated assessment of excess mortality due to thermal waves detected in Arkhangelsk in the period of 1999-2008 damage from heat waves reached 110 additional deaths from cold waves - 179 deaths. Thus, the total number of excess deaths during the study period, on average for the year was about 30.

The importance of climate change and its impact on mortality and other researchers noted, stressing the need for further research on the influence of climate on human [17, 18].

More attention is given to studying the effect of increasing the level of air pollution linked to global climate change on public health [12]. In the air the cities of Arkhangelsk, Severodvinsk, Novodvinsk and Koryazhma determined concentration of major impurities common to all sources of emissions (particulate matter, sulfur dioxide, carbon monoxide, oxides of nitrogen, benzo (a) pyrene) as well as specific pollutants (formaldehyde, hydrogen sulfide, carbon disulfide methyl mercaptan). In conjunction with a forest fire, this leads to a substantial reduction in air quality. Epidemiological studies suggest that even a short increase of daily average temperatures combined with a high level of air pollution with chemicals such as nitrogen dioxide and sulfur, particulate matter fine fraction (PM10), ozone, possible significant damage to human health in the form of increased mortality, increased the frequency of requests for emergency medical treatment for acute asthma, obstructive pulmonary disease, pneumonia, coronary heart disease, myocardial infarction, and cardiac arrhythmias. The most affected by such impacts sensitive groups of the population: the elderly, children and persons with chronic diseases [12, 13].

A team of researchers studied the impact of heat waves on hospitalization for circulatory diseases and respiratory diseases from April to September in 12 European countries. It was found that increasing the temperature by 1 ° C causes the growth of hospitalization for respiratory illness by 4.5% for all ages and of 3.1% in the 75 years and older [29].

Extremely hot weather may cause hyperthermia, heat stress and disturbance of renal function in people with poor thermoregulation. [32] It is shown that the population of South Australia over a 12-year period of uptake about kidney disease and acute renal failure has been enhanced during heat waves in comparison with non-hot period. [20].

It was established that the total amount of ozone in the atmosphere has a significant impact on the incidence dynamics of basal cell carcinoma, and, apparently, is a major factor in the dynamics of melanoma incidence in the European North. The resulting complex data analysis information has allowed developing a hypothesis mechanism of action of total ozone in the atmosphere (which is an indirect indicator of the level of UV radiation of the sun) on the incidence of malignant tumors of the

skin of the Arkhangelsk region population. Analysis of the malignant tumors' dynamics of the skin reveals a clear trend increasing incidence of basal cancer and melanoma population of Arkhangelsk (from 1983 to 2000 - 2 times) [10].

An analysis of the complex impact of the average daily temperature, wind speed, atmospheric pressure changes in the frequency of calls "emergency" in the Arkhangelsk region' population for some nosology forms showed that the increase in the average daily effective temperature for each degree is accompanied by an increase in the number of calls about injuries, poisoning and consequences of external reasons (for men - by 1.6%, among children - by 2.5% and in the age group 60 years and older - 3.0%) [15].

Most sharply changing weather conditions in extreme climates of the Far North affect the people' health of all age groups. This reflects person' meteo-dependence, expressed in varying degrees, depending on the overall condition of the body. The study of the climate change' impact on the conservation of physical and mental health of the Far North' population is an urgent problem in connection with the cases of emergencies that have arisen for reasons of human factor [2, 7, 8, 9].

Thus, the direct impact of climate change on human health is characterized by an increase in mortality and illness in the days of abnormally high or low temperatures, as well as the increasing number of deaths and injuries as a result of floods, storms and other severe weather events.

The indirect effects of climate change on human health is manifested in the deterioration of the living conditions of the population (demolition homes, roads, municipal infrastructure, including a shortage of good-quality water, food, etc.) which leads to the risk of infectious diseases (acute intestinal, enterovirus, rotavirus and hepatitis A virus).

One of the growth factors of infectious and parasitic diseases is the rise in temperature in winter. In connection with this change the traditional areas of pathogens and vectors of various diseases, such as tick-borne encephalitis. In northern Arkhangelsk region showed a trend toward an increase in the incidence of people' treatment in health care institutions about sucking ticks and tick-borne encephalitis cases. Thus over the period 2000-2009 rise in incidence occurred TBE (almost 60 times) compared with 1980-1989 [16]. A mathematical analysis demonstrated that in the central regions and most strongly changed synchronously as air temperature and the number of victims. It substantiates the position that climate change is a critical factor in the growth of disease.

Climate change Arkhangelsk region and Nenets Autonomous District may affect the diet of the northern regions' population, especially the indigenous ethnic group, in particular to reduce the quality of agricultural products and some food products grown in flooded farmland, suburban areas, and others territories, which, in turn, will lead to the emergence of various diseases of infectious, parasitic and non-infectious nature, caused by defective products (meat, dairy, fish, vegetables, fruit), such as diarrheal diseases, dysentery, salmonellosis, enterobiasis, ascariasis, giardiasis, diphyllbothriasis various mass poisoning al.

The traditional food of indigenous peoples includes eating raw fish and raw meat without heat treatment. Therefore infection occurs most often through these products. Also, raw fish is used, and the migrant population, who have adopted this custom from the indigenous population. In 2000 contamination whitefish endoparasites, in particular in the Pechersk diphyllbothriasis basin has increased by almost 2-fold compared with 1900.

According to the results of enzyme immunoassay parasitosis population of the Nenets Autonomous Okrug, we conducted in the period from 2002 to 2013, the situation deteriorated parasitic diseases. In 2013 the infection rate of the population exceeds the average rate of 7.6 times (average figure - 354.0 per 100 thousand populations, and in the Nenets Autonomous District - 2675.7).

Health problems of all population' groups are due to the degradation of permafrost. Features of Urban Development in the Arctic and sub-Arctic regions are linked primarily to the presence of permafrost. Frozen soils are unstable and dynamic over time. They are characterized by specific properties (rheology, subsidence. Heaving) and therefore extremely sensitive to external influences, easy to move from the frozen state to the Talos and back. This is accompanied by the development of unfavorable

and dangerous permafrost processes that need to be considered in the design, construction and operation of facilities in permafrost.

Professionals' research and observations indicate that there are numerous cases of emergency state structures, due to deformation of the base and the foundations that were not previously observed. A similar situation is observed and environmental safety facilities adjacent to areas where as a result of anthropogenic disturbances activated existing or develop new geocryological destructive processes that lead to irreversible changes in the hydrosphere, topography, vegetation, and others. The main causes deformations and environmental violations are changes in heat and water regime of soils as a result of anthropogenic impacts on land development and subsequent operation of facilities [11]. Increased seasonal thawing of permafrost (especially on the southern border of the Arkhangelsk region) threatens flood infrastructure.

And the negative side changes a lot of frozen breeds in the circumpolar zone: offers a high probability of returning to the ecosystem of especially dangerous infections of the XIX century by thawing soils in places of burial of people or animals that died from them (for example, anthrax and other burial grounds); brings to the surface of especially dangerous infections from past millennia remains of other fauna). Arkhangelsk region is an area endemic for tularemia. Since 2006, there has been rise in the incidence of the inhabitants of the region nosology form. The climate and landscape conditions contribute to the spread of the Arkhangelsk region in its territory of certain kinds of rodent vectors, which, in turn, creates the preconditions for the existence of the centers not only tularemia, and leptospirosis, hemorrhagic fever with renal syndrome, pseudotuberculosis. These processes occur on the territory of Yakutia, where there are a number of natural foci of infectious and parasitic diseases of humans and animals, such as brucellosis, tularemia, anthrax, rabies, hydatid disease, leptospirosis, trichinosis, and others.) [5]. Frequent floods and dangerous underflooding burial grounds and the threat of anthrax contamination of the population [15]. Floods repeated an average of 1 every 7-9 years and most often occur in Kotlas, Kholmogorsky and Vynohradiv districts (in the south-eastern and central parts of the Arkhangelsk region), as well as at the mouth of the Pechora River and in the area of Naryan-Mar. Over the past 20 years it has become a flood recurrence more often - an average of 1 every 2 years.

One of the most obvious effects of climate change is considered shrinking forests. It is observed in many parts of the Earth, including in the north of Russia. By shrinkage are themselves climatic anomalies, and they cause outbreaks of pests and diseases. Drying of spruce forests in the Arkhangelsk region, mainly in the area between the Northern Dvina and Pinega and in some neighboring regions has a great reputation. The reason for drying steel snowy winters and summer drought (in 2004 in the area of drying almost two months there was no rain and there was unusual heat for the North).

Unusual climatic phenomena, such as heat waves for the northern territories, leading to outbreaks of pests, causing great damage to the development of traditional industries of the North is forest processing, as well as in summer leads to numerous fires in the Arkhangelsk Region, creating an immediate threat to life and public health. Problematic for the region in this respect was 2010. Since the beginning of the fire season in 2010 recorded 352 forest fires, traversed the area was 14,210 hectares, the average area of the fire was 40.3 hectares. Compared to the fire season in 2009 the number of fires has increased by 4.9 times, and the area from them 78.9 times [15].

Existing climate change are not only negative, which people gradually adapted, using modern means of reducing the risk of unfavorable climatic factors, but also positive. Among the positive factors can be labeled by such as an offset to the north zone of comfortable living of people and reduce the heating period of residential and industrial buildings, increase agricultural production capacity in areas with adequate soil moisture, a favorable influence on ice conditions in the Arctic seas, contributing to the empowerment of the Northern Sea way, as well as facilitating the development of the Arctic shelf.

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infectious nature, caused by defective products (meat, dairy, fish, vegetables, fruit), such as diarrheal diseases, dysentery, salmonellosis, enterobiasis, ascariasis, giardiasis, diphyllbothriasis various mass poisoning, etc.

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In the Nenets have traditional features nutrition behaviors affect their health: eating venison, they are at increased internal exposure from natural and artificial radionuclides. The food chain is "reindeer moss - deer - a man" on which people come into an organism radionuclides It is a concentrate of impurities. After the testing of nuclear weapons at the site "A New Earth" in the Arctic tundra remained radioactive "traces". Radionuclides are held permafrost and do not extend beyond the "footprints". Melting permafrost helps spreading radioactive "traces", there is a risk of radionuclides in the water systems of the north.

Due to global climate change, along with the basic problems of the indigenous population of the Nenets Autonomous District (inaccessible medical care, nomadic, ethnic polymorphism, low tolerance to social and economic change and disasters, etc.) join new: transform habitats and hunting fisheries due to changes in the coastal zone, ice thickness varies in the reservoirs, there are additional injury in fisheries, and so on. e., the need to find new ways of reindeer migration, mass destruction of wild animals (rodents, partridges, wild deer, foxes) in connection with the advent of "Freezing rain" and ice on the surface of the vegetable layer; appearance in the northern latitudes of various infections, flooding burial grounds, "glaciers for storing food", and so on.

The later freezing of rivers and lakes in the tundra prevents transition nomadic herders from the summer pastures, located on the peninsula of Kanin, to winter pastures and base villages. For example, the average time of transition reindeer brigades to "mainland" and the base village Nes moved to summer pastures in the past 15 years for 5-6 weeks. In recent years, reindeer brigades manage to go only to the river in late November - early December. At 2-3 weeks reduced the length of stay reindeer teams at the winter pastures near settlements. Spring before they have to go to the north of the peninsula (not yet got off the ice from rivers and lakes). There is in general unavailability and inaccessibility of herders households increased by 8 weeks. Longer breaks traffic reports on the peninsula Kanin lead to unavailability of herders families to health care facilities, as well as to the rapid spending of the medical kits to reindeer brigades (because of their insufficient augmentable).

On the other hand, longer breaks transport links have an impact on access to medical and hospital care for the population assigned to the district hospital of villages and settlements at a distance of 60-120 km from the village of Nes. It affects the amount of planned doctors' visits district hospital for medical examination of the rural population.

Intensive melting of ice leads to disruption of traditional ways of the summer migration of polar bears. This explains the increase in the number of attacks on the person of polar bears due to the aggressive behavior of polar bears caused by chronic hunger. The appearance of polar bears creates emergencies and near the camps in the Arctic zone.

In connection with the intensive melting of Arctic ice conditions for almost year-round navigation of vessels on the Northern Sea Route, which is advantageous shipping option. The development of hydrocarbons in the North Sea, including the Arctic shelf, require an increase in ships for transporting liquefied gas and the influx of additional human resources in the High North from other parts of the country.

Industrial and environmental pressures on the Arctic region in the next decade will increase, regardless of the climate scenarios that puts on the agenda the task of adaptation (adapt) to the new changing environment.

In extreme northern conditions people are forced to adapt to changing environmental factors that will certainly affect the life' quality of northerners, especially the indigenous ethnic group, which is necessary to change the conditions of vital activity. With the development of new production facilities in the Arctic areas due to severe climate will the priority of the use of shift work. Additional efforts in the adaptation process of the body in a circular migration can lead to stressful situations, reduction of adaptive mechanisms and the development of pathological conditions, turning into a disease. The organization of the work is necessary to consider all the medical and psychological features of environmental and adaptation' capacity to a changing climate.

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