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## Social and medical problems of the population of the circumpolar countries – challenges of the modern development of the Arctic



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### Abstract

The article is based on a review of data, which were submitted in the foreign scientific journals, which reflect the results of the research, which were carried out in the framework of the discipline 'Public Health'. The characteristic of the social and medical problems of the population of the circumpolar countries in the early XXI century is given.

**Keywords:** *Arctic, North, public health.*

The Arctic is a vast geographical area, adjacent to the Northern Pole of the Earth, with an area of more than 22 million square feet. km. Six countries (Russia, USA, Canada, Denmark (Greenland), Iceland, Norway) have territorial possessions in the Arctic, and access to the Arctic Ocean basin. Together with some areas of Finland and Sweden, the total population of the circumpolar regions in the middle of the 2000s was 3.74 million people, of which 9% - are indigenous peoples. [31]

The last decades of the XX century were for the Circumpolar time of an active development of its resource potential. The economic effect of the latter, estimated at 30 trillion dollars, began to prevail in the minds of the management of the Arctic over the real threat posed by this process. Ecological and climatic problems, uncomfortable living conditions in the North, conditional reduction potential in life population, take a back seat to geo-strategic advantages that will extraction of natural resources in this region of the planet.

Since the beginning of XXI century, the study of all the aspects of the life of the population, either permanently or temporarily living in the circumpolar areas of the Earth, has become systematic. One of the

priorities in this process is to examine the state of the public health. For its implementation in the second half of the XX century, the national governments in the Polar Regions were created large research centers. Up to this moment, based on their accumulated amount of new knowledge that is sufficient to actually solve many of the social and hygiene problems associated with living in the Arctic. Another result of this research activity is the emergence of periodicals, which displays the results of studies related to the far north. To public health in this international edition is the journal of the Barents region «Circumpolar health».

The aim of this work is to systematize the information on the major problems of public health in the Arctic region, named by the researchers on the global level.

### **Methods**

The current review is based on an analysis of the data presented in the international scientific journals and displays the results of research carried out within the discipline of "public health" for the last 6 years (2006-2011). The selection of publications was implemented using resources information network MEDLINE (PUBMED). Search publications for review by the keyword «Arctic» 7352 gave a reference to the article (26/02/2012). When limiting the query words «Arctic» and «health» («The Arctic" and "health") - 1183 reference. On the number of articles were excluded publications that reflect the results of research on genetic characteristics of the indigenous peoples of the North, the results of the pilot studies, articles on the problems of zoology and veterinary science, historical reviews, articles, published before 2006. The survey also did not include material from the "non-fiction" literature. Considering these limitations, all were selected for analysis 37 publications.

### **Discussing the results**

Range of the scientific issues in the field of the public health in the northern circumpolar territories, which focuses the interest on the foreign researchers, is wide enough, even despite the fact that the subject has systematically investigated recently. Table 1 shows the results of the review. The four major groups of problems, aspects of which are mostly explored in the foreign research centers for the past six years.

*Table 1*

**Groups of the problems, the main categories and themes in the field of public health, identified in the review**

<b>Group of the problems</b>	<b>The main categories</b>	<b>The main topics</b>
The climatic features and the state of the Arctic environment and its impact on the human health	A. The influence of the Arctic climate on the health of the population B. The pollution of the environment B. Climatic changes	- The negative risks of the Arctic climate on the human health - Features of the anthropogenic pollution in the Arctic (associated with the development of its resource potential) -The impact of the pollution on the human health - The impact of the climatic changes on the population in the Arctic
The health of the indigenous people	A. Etno-specific features of the health status of indigenous peoples in the Arctic	- The low life expectancy -Lack of exercises -Genetic features

	B. "Westernization" way of life of indigenous people C. Features of the demographic situation D. Features of the risk factors for the health of the indigenous people of the North, depending on the country of the residence	- Characteristics of the impact of traditional risk factors of the drugs (smoking, alcohol, drugs) -High rate of infectious diseases
Features of pregnancy and childbirth; peculiarities of certain groups of diseases in the Arctic	A. Characteristics of pregnancy and childbirth B. Cancer C. Non-communicable diseases	
The main challenges of the health care system in the Arctic	A. The inequality in the access to the medical help B.Strategy of the prevention programs, taking into account the peculiarities of the Arctic	

### ***Features of the climate and the condition of the environment in the Arctic and its influence on the human's health***

The influence of the climatic conditions on the health and quality of life in the Arctic territories assessed by the overwhelming majority of researchers as any adverse [19, 26, 37]. Among the specific risk factors, the most significant are long-term exposure to cold, and the synergistic affect each other wind, precipitation and annual aperiodicity light. [19] Global warming has also affected on the health of people living in high latitudes [19]. In particular, in the Irkutsk study established a direct link between the sharp fluctuations in temperature (cold waves in winter and heat in summer) and the rate of the population of large cities. [26] Canadian and Finnish scientists have confirmed an association between living in the cold Arctic climate and higher infant mortality and lower life expectancy. Showed that an increase in average temperature in January for every 10 ° C (at the meridian flow from north to south) Increases the average life expectancy of six years and reduce the infant mortality rate by four per 1000 live births [37].

The research, conducted in the Yamal-Nenets Autonomous District, indicates the children born in the North, more prone to non-infectious risks to their health than children also live in the Far North, but born in the southern, more favorable climatic regions [32]. High salt intake, low physical activity, dyslipidemia, hyperglycemia, smoking, low magnesium concentration in the blood plasma, overweight, high blood pressure is a partial list of the risk factors, the prevalence of which this group is estimated as the highest [32].

The influence of the global warming as a factor that threatening the population's health status also is being studied in the foreign scientific schools. In addition to the individual epidemiological studies implemented large-scale national and international projects, which aim to coordinate joint efforts of the public services of health protection and public organizations? This direction is a priority for the World Health Organization (WHO).

In assessing the contents of the scientific publications on this topic were identified most important two aspects.

Firstly, global warming is the reason not only of the complication of the disease burden, fluctuations in mortality from specific states, but also brings with it a change in the living conditions of the Far North. This issue is particularly to indigenous peoples in relation to the potential risks to their traditional ways of food (breach of the conditions in the grazing of the deers or reduction of biodiversity of the ocean). [11] The research, conducted among the Nenets living on the island Vaigach (Arkhangelsk region), confirms this fact. More than half of the respondents had already been forced to change the usual way of life due to global warming. [12]

Secondly, improving of the transport accessibility of the Far North to the melting of multi-year ice can lead to increased migration from the southern territories of the countries bordering the Arctic Ocean. Experts see this as a serious threat to the indigenous people who may be at high risk for the spread of new infectious diseases, and further, have uncontrolled changing the traditional way of life. [11] Climate change causes increased incidence of injuries, stress, consumption of unsafe food and water [7, 14]. Population health danger lies in the inversion of the life cycles of pathogens dangerous diseases (including parasitic). [13]

Environmental pollution is another important social and hygienic problem of the Arctic. The main groups of pollutants relevant for the region are:

- 1) heavy metals (cadmium, lead, mercury);
- 2) persistent organic pollutants:
  - Industrial waste (poli and hlor having biphenyls);
  - Pesticides, chlorine-organic compounds (dioxins, furans, chlorinated dog-titsidy, DDT, geksa hlor benzin) [28].

There is the following general property of approaches to the study of the problem in foreign publications. Because the major industrial centers with a permanent population, which are out of Russia and norther to the Arctic Circle practically absent, foreign researchers are considering the indigenous people of the Arctic as a major group exposed to this threat. In particular, for several years continue to study the effects of anthropogenic pollution on the endocrine system, which is likely to be able to explain a significant sexual dimorphism among minority ethnic groups in the Arctic. [6] Evidence of the negative impact of the environment on health is recognized as a fact the higher the incidence of gastric cancer in comparison to the Sami population in southern areas of Sweden and Finland. [18]

Relatively new direction of the scientific research for the foreign experts is studying the population health threats of the population in the circumpolar areas that come with development of resource potential of the Arctic. Oil and gas production in the continent and its offshore dangerous potential environmental impacts, which can radically change the living conditions of indigenous peoples of the North. [4] Anthropogenic pollution of the Russian Arctic is also studied abroad. [28] The researchers note the irregularity and lack of systematic data collection on the state of the environment in our country, even in recent times, alt-

though they had confirmed the fact that in the last decade, the blood in the Russian Arctic has decreased significantly metabolite concentrations of organic pollutants [28].

In addition to the representatives of the indigenous people of the North, to the group of the most exposed to the pollutants include pregnant women and children. They are characterized by generally higher risks of cancer, disorders during pregnancy and birth, low birth weight of the fetus at birth, congenital abnormalities (see below).

### ***The health of the indigenous people***

There are dozens of indigenous people (one in Russia - about twenty), the state of health of a group which is a popular research topic of foreign experts in public health, who is living in the Arctic regions of Russia, the USA (Alaska), Canada, Denmark (Greenland) and Norway. The study of this problem is in terms of three basic things:

- 1) high exposure of the indigenous people of the Arctic to the natural and anthropogenic pollutants, climatic changes;
- 2) access to the health care disparities (in comparison with the southern regions and, depending on the socio-economic welfare of the country of residence);
- 3) The "Westernization" of the individual lifestyle of indigenous people (mainly the Western Hemisphere).

In general, the state of health of the small ethnic group of the circumpolar territories is characterized by the following features

- ✚ low life expectancy (in comparison with the population of the southern territories);
- ✚ high infant and child mortality;
- ✚ high prevalence of the infection and number of non communicable diseases;
- ✚ high level of injuries, suicides, compared with the population of the southern territories.

In turn, the quantitative and qualitative study of these factors is complicated by certain behavioral characteristics of the indigenous peoples of the North:

- ✚ high prevalence of substance use, which influence on the psyche (nicotine, alcohol, drugs (for American Indian Alaska));
- ✚ unbalanced diet (more calories, containing more cholesterol and less minerals and vitamins);
- ✚ sedentary lifestyle (as a consequence of "Westernization" phenomenon that is characteristic of American and Canadian Indian tribes). [25]

Available data indicates a stronger combined of the negative influence of these risk factors on the health status of a group of representatives of the small ethnic groups of the Far North. For example, for the Inuits of the North America found that smoking is associated with a lower dietary intake of many essential trace elements and vitamins. [27] Inuits smokers consume less thiamine, niacin, vitamin B6, folate, magnesium, sodium, protein, omega-3 fatty acids, iron, vitamin B12 and selenium [27]. Almost half of the male smokers and women consume less than the required amount of saline-soluble vitamins (A and C), folate,

calcium, and magnesium. This, in turn, is the additional risk of metabolic disorders and complication of the disease burden. [27]

Unlike other countries that have territorial possessions in the Arctic, Russia's more relevant is the study of health risks to the population, which does not relate to a group of indigenous people. This is due to many reasons. In the former Soviet Union policies to stimulate migration to the northern regions consistently implemented for decades, thereby, on the one hand, the radical change in the ethnic composition of the population of the traditional Arctic, on the other - has caused the unique demographics of the region. For other countries, by contrast, historical residence of Europeans and their descendants in the Arctic was not a mass phenomenon. Even now, the circumpolar territories Europeans are in the majority in the "shift camp" mode. It is therefore considered that the study of the effect of prolonged exposure to the environment and living conditions in the Arctic on their health is an extremely complex task.

### ***Ethno specific features of the health of the indigenous population of the Arctic***

The health status of indigenous people has a number of features that are caused by genetic factors and living conditions of the Far North. Fairly common for small ethnic groups Circumpolar is a relatively high prevalence of thyroid autoimmune disorders. [9] Life expectancy in the population of indigenous people is generally lower in comparison with the population of the South. But this feature is relative and depends on the socio-economic characteristics of the region and country. Even in prosperous Canadian Inuit life expectancy ten years less than the national average, despite the large number of times that Government measures to prevent disease and promote healthy lifestyles. [23]

Considering the prevalence of some important groups of diseases in the population of the small ethnic groups have following features. First, it is a high variability in incidence and mortality from cancer. For example, all the Sami living in the northern parts of Norway, Sweden, Finland and the Kola Peninsula, the incidence of this group of diseases is less than for the population of the southern regions (standardized to 30% on average). [18] The exception is cancer of the stomach, the researchers explain that special diet of the people (salted fish, smoked meat, etc.). [18] This fact is even more surprising in the sense that the area has repeatedly been Saami radioactive fallout (tests on Novaya Zemlya in the 1950s and 1960s, and in 1986, following the Chernobyl accident). [18]

The Arctic indigenous people bear a significant burden of noncommunicable diseases. The prevalence of some of them on tens of percent is higher than the average for the population of the southern territories. [31] In particular, for the Inuits of Greenland is characterized by a significant incidence of both forms of diabetes mellitus (40% above the world average). [31] For the indigenous people of the northern Russia (Nenets, Selkup) characterized by a high incidence and prevalence of tuberculosis, rheumatic fever, congenital heart disease, alcoholism. [31] At the same time, among the peoples, traditional way of life, there was low in comparison with the population of the southern territories, the incidence of coronary heart disease [31]. The indigenous person of the Arctic Circle is characterized by a high prevalence of hypovitaminosis of D [30]. In turn, researchers have drawn parallels between this feature and the high preva-

lence, in comparison with the population of the southern territories, rickets, cancer, diabetes and obesity [30].

### ***«Westernization» of the life style of the indigenous population***

Historically, the indigenous population in the Arctic has physical active on-times of life, because they have difficulties in obtaining food. Today, the representatives of the small ethnic groups receive funding from the budget of their states; have numerous social benefits, so that the last time they are gradually moving away from the traditional activities. [31] Some indigenous people in the Arctic at the beginning of the XXI century were so embraced by as it is called "Western" way of life, creating a real threat to the status of their group health. This process is accompanied by a significant decrease in the physical activity, a high prevalence of behavioral risk factors (smoking, alcohol consumption and drug use) among small ethnic groups called "Westernization" [3, 31]. The consequence is widespread in the population of the indigenous people (especially the Western Hemisphere), obesity, which increases the risk of cardiovascular disease [31]. A large proportion of women, for example as Intuits of the North America and Greenland, continue to smoke and consume alcohol, even during pregnancy, causing even greater harm to the health of future generations [24].

Representatives of some of the indigenous people of the Arctic have their own unique "collections" of risk factors. For American Indians, for example, is characterized by a significant prevalence of marijuana, cocaine, inhaled substances and chewing tobacco, while the indigenous people of Russia – is alcohol. [29]

"Westernization" of the way of life of the small ethnic groups of the North is the reason of the number of the negative social phenomena. [1] Results of the systematic review conducted by. V. Leti with colleagues in 2009, according to the striking increase in the death rate from suicide for the young people living in the some Arctic regions (up to twenty-fold compared to the world average). [22]

### ***The features of the risk factors for the health of the representatives of the indigenous population of the North***

The diet of the indigenous people, as the risk factor for the health has the longest history of the research. M.V. Lomonosov in the XVIII century connected it to the physical features of a person's status. In particular, the Lapps (Sami), according to his words, the food consumed mostly fish (Grombah S.M., 1961) On the contrary, samoyadi (Nenets) in his memoirs - "the growth of them is not small, broad and strong," and for this reason, Lomonosov believed in the meat diet (Grombah SM, 1961).

In the XX-XXI centuries, appeared the methods that allow researchers to determine the level of the influence of the diet on the characteristics of diet on the human health. Therefore, indigenous peoples can again be divided into heterogeneous groups. Historically, the small ethnic groups of the North, mainly consumed fish rich in polyunsaturated fatty acids and selenium, characterized by relatively low prevalence of abnormalities of the cardiovascular system, cancer [3, 31]. The more significant exercises they had the less negative impact of climatic conditions was. But in the XXI century, a number of fish diet of indigenous people of the North began to be seen more as researchers have a risk factor that is associated with a high con-

centration of it hazardous to human health. In other words, small ethnic groups of the Arctic have been the victim of industrialization in Europe, America, and later in China and India due to the transport of pollutants from the air masses and ocean currents.

For the representatives of the indigenous people of the North have relatively high in comparison with the population of the southern territories, the incidence of infectious and parasitic diseases (such as giardiasis, tularemia) [13]. This is due to the traditional crafts and environmental conditions [16].

### ***Features of pregnancy and childbirth; the features of the longing of the several groups of the illnesses in the Arctic***

Despite the number of studies, particularly pregnancy and childbirth in the regions of the Far North in general are badly studied. [3] Among the most recent issue of congenital anomalies of the fetus is the most urgent, which contributes to the presence of a set of risk factors: pollution, lack of study of the so-called "talidomidovoy 'problems, life of women living in the Far North. [3] Comprehensive analysis of this problem and prevent the fact that the creation of specialized registers, accounting fetal anomalies in the northern regions is relatively recent (15-20 years ago). The degree of accuracy and completeness of the data contained in them, still due to the level of socio-economic development of the region. Accordingly, the results of research conducted on the basis of such registers and databases in full cannot be transferred to the general population. [3] It should be noted that the Murmansk region in Russia is one of two places in the Arctic (except Alaska), where the registers are ethno-specific data.

The results of the research have shown the deterioration in the health of the pregnant women, who are living in the Far North [2, 10, 35]. In particular, over the last thirty years in the Murmansk region (1970-2000's) increased to the half the proportion of women with anemia during pregnancy: from 43.7 to 89.8% [10]. Fetal weight during the birth for mothers, who had suffered from anemia, is in average of more than 48 grams. [10] At the same time, the exclusion from the analysis of confounding factors, women who had anemia, had a lower probability of stillbirth. (OR = 0,68; 95 % CI 0,52, 0,89) or premature confinement (OR = 0,66; 95 % CI 0,58, 0,75) [10].

The influence of the climatic factors on the course of the process of pregnancy is much less important in comparison to the quality, access to care and overall socio-economic well-being of individual territories of the Far North. In particular, in two adjacent regions (Murmansk region and the northern Norway), the index of the perinatal mortality is different in almost half (10.7% vs. 5.7 per 100 000 in the 2000s). [2] The situation is similar to the prevalence of preterm birth (8.7 vs. 6.6%, respectively) [2].

The state of the dentist health of the people, who are living in the Far North, to the same extent due to the socio-economic welfare of the country and climate. This is another aspect of inequality in the status of health of the various countries bordering the Arctic Ocean. In particular, in Russia, 91.8% of adolescents have fifteen years of decay, and the index of the CPU (carious, sealed, extracted teeth) the average equal to 4.92 [15]. Have its own characteristics depending on where you live teen. In the cities of the Russian Arctic average extracted teeth is lower than in rural areas (2,15 vs. 2,95,  $p = 0,006$ ), while the fillings -

higher (2,71 vs. 1,79,  $p < 0,001$ ) [15]. The higher incidence of dental caries is also noted in 4-5-year-olds and 12-15-year-olds in Alaska (USA) in comparison with the teenagers of the southern states - 7.3 and 5.0 on average decayed teeth in the north versus 1.6 and 1.8 is in the south. [8]

For the population of the Arctic areas of the Western Hemisphere (Alaska, Canada, Greenland) is noted with the high level in comparison with the southern areas, of the prevalence of infectious diseases, sexually transmitted infections (chlamydia), but especially among young people under the age of 20 years [21].

Due to the annual light aperiodism for the Arctic population is typical, for example, a particular form of migraine, the occurrence of an attack that is associated with the elucidation of the weather, but has no annual cycles [5].

### ***The main challenges of the health care system in the Arctic***

The most important challenge to the national health systems of countries, who have territorial possessions in the Arctic, is the inequality in access to the health care in the Far North in comparison with residents of the southern regions. The proof of this statement is a higher incidence of certain diseases, chronic course of much pathology, late diagnosis and, consequently, higher death rates from a number of states (see above). Even more exposed to potential threats to the indigenous and rural populations of the Far North [20, 23]. At the same time the legislation of almost all countries that have territorial possessions in the circumpolar regions, ensures equal access to health care [23].

For the circumpolar regions marked following characteristics of the health service: significant variations between the documented duties of the medical staff and the amount of their actual work. [23] This is mostly typical to the middle staff. Abroad is recognized, that the role of middle staff in the rural areas in the circumpolar territories almost always goes beyond its jurisdiction. [6] In addition to the implementation of the medical surveillance of chronically ill sister often had to provide medical care in emergency situations. [23].

The treatment of the chronic patients with the principle of continuity of the process - is another challenge to the health systems of the Arctic countries. [23] In this regard, particular attention is paid to the development of the specialists abroad of so-called "primary care» («primary care»), which can be translated into Russian as primary health and social care. [23]

Due to the nature of the health care in areas of the Far North (low population density) the national health services are being actively implemented in the practice of information technology [23]. There are two telemedicine systems: the so-called «tele health» and «e health» [6]. System «tele health» - is "the use of communication and information technologies to implement or support the implementation of health care services, where participants in the process (that is, doctors and patients) divided space" [23]. System «e health» - is the health care and medical information provided or enhanced through the Internet and related technologies. [23] The latter system is used as a means of counseling or training specialists in remote areas of the central scientific or medical centers [23]. In the scientific publications, the focus of researchers

is to study the following aspects of this theme: the application of telemedicine capabilities in specific circumstances; perception by physicians and patients of the fact treatment with telecommunications technology and economic efficiency of telemedicine [23].

The current review is based on the analysis of the data presented in the international scientific journals and displays the results of the research carried out within the discipline of the "public health" for the last 6 years (2006-2011). The selection of publications was Implemented using resources information network MEDLINE (PUBMED). Search publications for review by the keyword «Arctic» 7352 gave a reference to the article (26/02/2012). When limiting the query words «Arctic» and «health» («The Arctic" and "health") - 1183 reference. On the number of articles were excluded publications that reflect the results of research on genetic characteristics of the indigenous peoples of the North, the results of the pilot studies, articles on the problems of zoology and veterinary science, historical reviews, articles, published before 2006. The survey also did not include material from the "non-fiction" literature. Considering these limitations, all were selected for analysis 37 publications.

### **Conclusion**

Public health in the circumpolar areas is one of the most researched topics in foreign research centers. In the framework of clearly determinate number of areas in which focused attention of epidemiologists and experts. In this review, four of these directions are:

- 1) The features of the climate and the state of the Arctic environment and its influence on the human health;
- 2) The health of indigenous people;
- 3) Characteristics of pregnancy, childbirth, and characteristics of the individual groups of the diseases in the Arctic;
- 4) The main challenges the health care system in the Arctic.

In each of the groups of the above-mentioned research problems abroad, it have been developed their own concept of perception, and thus the set of the research questions, research methods and interpretation of results. Certain complexity of the study of the social and demographic problems in the Arctic is the heterogeneity of its population. The indigenous people of the Far North have unique risk factors for your health than the risk of descendants of Europeans settled in these areas recently. Accordingly, in the foreign studies a clear trend considering all the problems of the public health interventions for groups identified above. This is a feature of the European and American Studies.

Another feature is the interstate nature of the research. Their results in this case are more scientific and practical value, as it allows estimating the contribution is the socio-economic component within certain social processes in the Arctic. Accordingly, it allows professionals to national health services to consider the effectiveness of the experience of foreign colleagues.

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