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Military Technogenesis from The Positions of Areas of Risk to The Health of the Working Population.

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ABSTRACT

The work is devoted to industrial ecology with the study of aspects of cancer incidence taking into account the formation of risk factors in areas with different types of technogenesis. The data of cancer risk in terms of oil production, woodworking, military, transport, agricultural, celnometallicheskij types of technogenesis, as well as their comparative evaluation, discussed in More detail causal relationships in a military type of technogenesis. On the territory of the military technogenesis of the Udmurt Republic (UR) conducted epidemiological analysis of levels of indicators of cancer incidence and mortality from neoplasms in comparison with national average values and in comparison with other territories of technogenic pollution. The list of substances relating to priority pollutants in this area and the type of technogenesis. On the basis of one-dimensional methods of statistical analysis set the priority nosology (nosology cancer risk), estimated dynamics for a ten-year period of observation, calculated the forecast values for 2020 Established that the nosology of risk in military technogenesis are leukemia among men of 30-39 years. For each age range, we define the nosology, characterized by into indicator values. The data obtained are of diagnostic value, as they help to understand the possible causes and factors responsible for the occurrence of cancer in this area.
Keywords : military technogenesis, cancer incidence, cancer risk.

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INTRODUCTION

Malignant neoplasms (MN) are the most important biomedical problem of the modern world, which occupies the leading positions among the reasons of population health potential decrease. Despite the efforts made by the international community, there is a steady increase in cancer incidence and mortality [5,12,11,13].

Udmurtia is one of the production administrative territories of Russian Federation. Over 1.2 million of people live in Udmurtia. About 300 thousand of them are employed in industrial enterprises, 115 thousand among these 300 thousands are Women. Women work in all areas of the economy: in agriculture and forestry (25.6%), construction (3.2%), transport and communications (8%), defense (15.8%) and the automotive industry (5,2%). The rest are employed in other industries. 28% of women work in conditions that do not meet sanitary requirements. More than 9% of women are engaged in heavy physical labor, more than 12% are exposed to the adverse effects of microclimate, 4% are exposed to physical factors. Udmurtia territory is the territory of several types of technogenesis combination. In accordance with the dominant theoretical conceptions, the level of industrial development in Udmurtia, the data of agriculture chemization, geographical analysis data Udmurtia territory is divided into seven technogenic pollution areas, depending on the predominant anthropogenic impact on the biosphere: military, agricultural, petroleum, ferrous metallurgy, wood processing, transport, fuel and energy types of technogenesis [9,10]. Technogenesis is the process of natural system changes under the influence of industrial activity. It is based on the transformation of biosphere, called by a set of geochemical processes related to technical and technological activities of people on environmental extraction, concentration and regrouping of chemical elements, their mineral and organic compounds.

The problems in the relationship of society and a man-made envtronment appeared in recent decades, mainly as the result of the latest scientific and technological achievements in industry, nuclear energy, as the result of agriculture and daily life chemization [1,2,14,17,18]. The contradictions are not solved and they become more serious [11,15,16]. The ecological role of the Udmurt Republic as the part of Russia is determined by its geographical position and rge place in environmental management organization system [6]. The industrial potential, the urbanization of majority of rural areas in Udmurtia develop a man-made pollution of the environment and make a significant contribution to the depopulation processes [7,8]. Oil production and other resource industries, which lead to resource intensity increase of the economy occupy the leading positions in the Republic economy structure during recent years [6]. The presence of chemical weapon reserves and the companies of its disposal - the territories of the military technogenesis are noteworthy [3,4].

METHODS

In order to evaluate the indicators of cancer incidence, population morbidity and mortality the data from two forms of state statistical reporting were used: the annual report about the patients with malignant neoplasms (MN) (Form №35) and the annual report on the diseases with malignant neoplasms (Form №7). The period of follow-up was during 2004-2013. Cancer Risk (CR) indicators were calculated as the ratio of cancer incidence cumulative rates. The reliability evaluation was carried out using one-dimensional statistical analysis.

RESULTS

When you compare the territories of different types of technogenesis according to intensive indicators of cancer incidence, morbidity and mortality in all nosological forms of neoplasms by single factor disperse analysis the territories revealed significant differences ($P<0.001$).

During the analysis of military technogenesis area performances in comparison with other man-made territories it was found that military technogenesis is differed by large values ($P <0.05$) of ovary malignant tumor incidence (6,6°/₀₀₀₀); the incidence and morbidity of larynx malignant tumors (5,2 and 22,8°/₀₀₀₀ respectively); the morbidity and mortality from malignant neoplasms of trachea, bronchi, lungs (42,0 and 37,2°/₀₀₀₀ respectively); the incidence, morbidity and mortality from skin cancer, excluding melanoma (21.7, 179.7 and 1,6 °/₀₀₀₀, respectively); the morbidity of bladder malignant tumors (23,5 °/₀₀₀₀), the malignant tumors of oral cavity and pharynx (29.4 °/₀₀₀₀; the malignancies of colon 51,0 °/₀₀₀₀; the malignant tumors of rectum, 71.9 °/₀₀₀₀; leukemias 33,1 °/₀₀₀₀.

During the analyzed ten year period on the territory of military type of technogenesis the incidence of bladder malignant neoplasm increased 9.5-fold (from 2.3 to 21.3 per 100,000 population per year); the incidence of malignant neoplasms of rectosigmoid connection, rectum, anus increased 5.6-fold - from 4.4 to 24.7 °/₀₀₀₀, the incidence of malignant lymphomas increased 4.9-fold - from 2.2 to 10.8 °/₀₀₀₀. The increase of malignant neoplasm rates: the incidence of malignant tumors of the prostate gland increased 4.9-fold during the study period - from 11.5 to 57.2 °/₀₀₀₀, the incidence of malignancies among children under 14 years increased 3.5-fold - from 2, 2 to 7.7 °/₀₀₀₀, the incidence of breast malignant neoplasms increased 1.96 fold: from 176.4 to 345.8 per 100,000 population per year. The mortality from stomach cancer increased 2.8-fold, the death rate from breast cancer increased 2.7 fold, the cancer of rectosigmoid connection, rectum, anus increased 1.96 fold.

The calculation of cancer risk indicator was performed for all types of technogenesis inherent in the Udmurt Republic (Table 1). The second position (CR 1.14) occupies the indicator for the territory of the military type of technogenesis. During the analysis of specific nosological forms the highest values confirm the priority positions. The highest values are calculated for leukemia (CR 5.2), malignant tumors of the uterine body (CR 4.9), malignant neoplasms of trachea, bronchus, lung (CR 4.2), malignant neoplasm of breast (CR 4.1) (Table 2). CR indicator is calculated for each nosology by age and sex, which made it possible to identify a priority gender and age group. Nosology risks are defined in each age category. In the age category of 20-29 years the leading position is occupied by malignant neoplasms of rectosigmoid connection, rectum, anus and bone malignancies among women (CR, 12.5 and 5.3, respectively), the malignant neoplasms of trachea, bronchus, lungs among men (CR 12,4). The maximum values of the indicator for malignant neoplasms of trachea, bronchi, lungs and skin cancer among women are calculated at the age of 30-39 years (CR 5.9 and 5.0, respectively), the men of this age group have the leading positions in malignant neoplasms of thyroid gland (CR 3.4), concerning the malignancies of hematopoietic and lymphoid tissue (CR 2.9). At the age of 40-49, the highest values were calculated for men with oropharyngeal malignancies (CR 4.2) and the malignant tumors of the bladder (CR 2.8), the malignant tumors of salivary glands among women (CR 6.6) and malignant neoplasms of rectosigmoid connection, rectum, anus (CR 3.0). For the age group of 50-59 years the priority positions for men are malignant prostate tumors (CR 2.6), the malignant neoplasms of a tongue for women (CR 12.5). At the age of 60-69 years the calculated values of cR indicate the risk of malignant bone tumors development and malignant tumors of thyroid gland development among women (CR 5.6 and 2.1, respectively) and melanoma among men (CR 2.7). At the age of 70 years and older the highest values for the malignant tumors of nasopharynx and nasal cavity malignancies among women were determined (CR, 12.5 and 6.0, respectively), and the malignant tumors of nasal cavity, melanoma among men (CR 3.7 and 3.4, respectively).

The method of trend modeling on the basis of polynomial functions (R^2 = 0,6-08) the predictions of the population cancer rates in 2020 were calculated for the territories of all types of man-made pollution. The forecasting indicator for the population of military technogenesis areas is the most unfavorable one.

CONCLUSIONS AND DISCUSSION

The indicators of standardized relative risk were calculated and made it possible to determine the priority nosology and gender and age group (technogenesis type - risk nosology - gender and age group): a military type - leukemias - 30-39 years old, males. The working age among risk groups is noteworthy one. Male population is more severely exposed to risk.

The models of cancer rates prediction for 2020 show the high intended level of population cancer rates in the conditions of military type technogenic pollution.

The calculations in the mathematical models of forecast demostrate the cancer level reduction extent within the terms of emission reduction. The military type technogenesis area is determined, which will not show the cancer rate reduction even with the minimization of emissions.

The priority Pollutants on the technogenesis areas include the following ones: dust (total amount of solids), lead, cadmium, arsenic, benz(a)pyrene, copper, zinc, manganese, chloroform, formaldehyde, sulfur dioxide, nitrogen dioxide. The comparative assessment of cancer risk on the territories of different types of technogenesis identified the most vulnerable territory - the teritory of the military type of technogenesis.

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1. The epidemiological analysis of malignant tumors on the territory of a military type of technogenesis during the period 2004-2013 found significantly high incidence rates in a number of nosological forms; the forecasting of intensive indicators during the period up to 2020 confirms a steady trend.
2. The risk nosology at this type of technogenesis are the leukemias among 30-39 year old men (cancer risk indicator 5.2).
3. The structure of oncologic pathology peculiar to each type of technogenesis area, and military technogenesis in particular, the list of nosological forms which defines the range of oncological troubles have an important diagnostic value, as they help to understand the possible reasons and factors responsible for the occurrence of cancer on this territory.

Table 1. Cancer risk indicators at different types of technogenesis

Type of technogenesis	Cancer risk (CR)	χ^2
Woodworking	1,18**	14,5
Military	1,14	5,0
Energy	1,04	9,3
Ferrous metallurgical	1,02**	17,9
Agricultural	0,99**	12,5
Transport	0,93*	4,4
Oil	0,88*	5,4

Reliable differences (* - P<0,05, ** - P<0,001).

Table 2. Cancer risk indicators at military technogenesis

Nosology ND	Cancer risk (CR)	Gender and age priority
leukemia	5,2	30-39, males
uterine body	4,9	60-69, females
trachea, bronchi, lungs	4,2	20-29, males
breast	4,1	50-59, females
larynx	4,0	70 and older, males
Other skin ND, excluding melanoma	3,8	50-59, males
bladder	3,5	40-49, males
ovary	3,5	60-69, females
bones and soft tissues	3,4	60-69, females
skin melanoma	3,1	70 and older, males
oral cavity and pharynx	3,0	40-49, males
stomach	2,9	30-39, females
colon	2,9	60-69, males
prostate	2,9	50-59, мужчины
thyroid gland	2,8	30-39 лет, males
esophagus	2,8	40-49, males
rectum, rectosigmoid connection, anus	2,8	20-29, females
cervix	2,5	40-49, females
lip	2,3	60-69, females

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