

# ON THE SITUATION WITH ACUTE POISONING WITH ALCOHOL-CONTAINING PRODUCTS OF THE POPULATION OF THE RUSSIAN ARCTIC

Yu.A. Novikova<sup>1</sup>, N.A. Tikhonova<sup>1</sup>, V.N. Fedorov<sup>1</sup>,  
A.A. Kovshov<sup>1,2</sup>

<sup>1</sup> Northwest Public Health Research Center, St-Petersburg,  
Russia j.novikova@s-znc.ru

<sup>2</sup> North-Western State Medical University named after  
I.I. Mechnikov

DOI: 10.24412/2658-4255-2021-3-00-05

## ABSTRACT

The purpose of the study was a comparative analysis of the indicators of acute poisoning cases with alcoholic products of the population living in 4 regions of the Russian Arctic and the identification of risk areas. We used the regional bases of toxicological monitoring for 2008-2020 in 4 regions of the Arctic zone of the Russian Federation (Murmansk Oblast, Nenets Autonomous Okrug, Yamalo-Nenets Autonomous Okrug and Chukotka Autonomous Okrug). The research found that risk areas of poisoning with alcoholic products are the Nenets Autonomous Okrug and Chukotka Autonomous Okrug. Despite a pronounced trend towards a decrease in the rates of acute poisoning among the population of these regions to levels below the national average, the problem of poisoning with alcoholic products remains extremely relevant. Considering that the consumption of alcoholic products in the northern regions is traditionally high, it is necessary to improve the method of toxicological monitoring and in-depth study of the causes of poisoning.

**KEYWORDS** toxicological monitoring, acute poisoning with alcoholic products, Russian Arctic, risk areas

## Introduction

To solve the problems of improving public health and forming motivation for a healthy lifestyle, it is necessary to develop targeted measures: those aimed at reducing the amount of alcohol consumption, those preventing acute poisoning of chemical etiology, and those implementing programs in

educational institutions for preventing the consumption of alcohol and drugs by children and adolescents [1].

In the structure of morbidity and mortality of the Russian population, the class «injuries, poisoning and the consequences of other external causes» occupies the third place after the pathology of the

cardiovascular system and neoplasms. Acute poisoning of chemical etiology (T36-T65) includes poisoning with alcohol-containing products (ethanol, methanol, 2-propanol, alcohol surrogates, etc.), narcotic substances, medicaments, and other monitored substances: carbon monoxide, corrosive

substances, aromatic hydrocarbons, etc. [2]. Since 2008, Rospotrebnadzor (Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing) bodies and organizations have been conducting toxicological monitoring, which includes personalized collection of data on acute poisoning, their assessment, analysis and forecast of the situation in order to identify areas of trouble and population groups that are unfavorable in terms of frequency of registration of acute poisoning of chemical etiology [3, 4].

In 2020, there were 103,206 cases of acute poisoning of chemical etiology registered on the territory of the Russian Federation, including 22,718 cases with fatal outcome. In comparison with 2008, there is a decrease in the indicators of acute poisoning, and in 2020 the lowest level of acute poisoning was registered (71.1 per 100 thousand population). In the structure of acute poisoning of chemical etiology in 2020, as in previous years, the leading place is occupied by poisoning with alcohol-containing products with a specific weight of 35.2 % of the total number of poisonings and 46.5% of the total number of fatal poisonings. Despite the decrease in the indicators of acute poisoning with alcohol-containing products, there is an increase in the proportion of poisoning with fatal outcome to the total number of cases of acute poisoning

with alcohol-containing products [5].

The problem of acute poisoning of chemical etiology remains relevant in a number of regions of Russia [6-13]. The highest level of morbidity and mortality from alcoholism is observed in the Northern and Arctic regions [14, 15]. Indicators of acute poisoning of chemical etiology in 2007-2016 in the subjects of the Russian Arctic were lower than in the Russian Federation as a whole, the territories of trouble were the Arctic territories of the Arkhangelsk Region and the Krasnoyarsk Territory [16]. The specific weight of alcohol-containing poisoning in the total structure of acute poisoning of chemical etiology was 36.9 %, which was higher than the national average (32,9 %).

### **The purpose of research**

The purpose of research is to analyze the indicators of acute poisoning by alcohol-containing products of the population in the subjects that are completely included in the Russian Arctic – the Murmansk Region, the Nenets Autonomous District, the Yamalo-Nenets Autonomous District, and the Chukotka Autonomous District, and to identify the unfavorable areas.

### **Materials and methods**

For the analysis following data were used: 2008-2020 data from the Federal Information Fund for Social and Hygienic monitoring (section «Toxicological monitoring») for the Murmansk Region and

the Autonomous Districts of Nenets, Yamalo-Nenets and Chukotka, and the Russian Federation as a whole [3], Rosstat data on the population (<https://rosstat.gov.ru/>).

The levels of acute poisoning with alcohol-containing products (per 100,000 population), including those with fatal outcome, were calculated. The specific weight of poisoning with fatal outcome from the total level of poisoning with alcohol-containing products was calculated. The normality of distribution in the samples, including intensive indicators of acute poisoning (incl. fatal) in the studied territories for 2008-2020, was evaluated according to the Shapiro-Wilk test. Descriptive statistics for each study sample included calculation of the average chronological values and 95% confidence interval (CI), median and interquartile range (25 and 75 percentiles). In addition, in the dynamics for 2008-2020, the average rate of increase in the level of acute poisoning was calculated for each analyzed territory, trends were constructed with an indication of the model approximation coefficient ( $R^2$ ). To compare the average indicators of acute poisoning in the studied regions with the territory of the Russian Federation as a whole, in the case of a normal distribution in the samples, the T-criterion for independent samples and the Levin criterion of equality of variances were used, arithmetic averages and 95% CI were analyzed.

If the distribution was different from normal in at least one of the samples, the Mann-Whitney criterion was used, medians and interquartile ranges were analyzed. The critical significance level of the null hypothesis was assumed to be 0.05, the exact 2-sided significance of the criteria (the error value p) was calculated. Such programs as IBM SPSS Statistics v. 22 and Microsoft Office Excel 2010

were used for statistical data processing and charting. The territories of trouble were additionally determined in accordance with the criteria set out in [17].

**Результаты исследования**

On the territory of the analyzed subjects, poisoning with alcohol-containing products occupies the leading place in the structure of poisoning. In 2008-2020

the average indicators of acute poisoning with alcohol-containing products (by arithmetic averages or medians) in 3 subjects of the Russian Arctic (except the Nenets Autonomous District) are statistically lower than the average Russian indicators (Table 1).

The leading places in acute poisoning with alcohol-containing products are occupied by the Chukotka and Nenets Autonomous

Table 1

Indicators of acute poisoning by alcohol-containing products in 2008-2020 (per 100,000 population)

Year / statistics data	the RF	the Murmansk Region	the Nenets Autonomous District	the Chukotka Autonomous District	the Yamalo-Nenets Autonomous District
2008	47,4	39,0	44,8	22,1	7,9
2009	49,9	27,8	47,2	18,5	3,3
2010	48,6	24,3	61,6	39,7	8,1
2011	43,8	20,7	21,3	31,5	6,5
2012	38,8	12,2	61,9	43,3	6,7
2013	36,4	9,0	69,2	27,6	10,0
2014	33,6	14,4	35,1	23,7	8,1
2015	34,6	16,3	23,1	13,8	9,8
2016	32,9	17,8	17,6	5,9	8,8
2017	32,0	17,2	22,4	7,9	8,0
2018	35,5	15,5	22,7	23,6	6,1
2019	34,5	12,4	14,5	20,3	7,0
2020	25,0	12,8	16	16,1	9,6
Average growth rate (%)	-4,8	-8,2	-7,6	-2,4	1,5
Average value	38,1	17,8	35,6	22,9	7,6
95% (CI)	33,4-42,4	13,3-23,3	23,4-47,0	15,9-29,3	6,6-8,8
Median value	35,5	16,3	23,1	22,1	8,0
Midspread	33,3-45,6	12,6-22,5	19,5-54,4	15,0-29,6	6,6-9,2
Significance (p) of the Shapiro-Wilk criterion	0,273	0,046	0,040	0,832	0,265
Significance (p) of the T-test (*) or the Mann-Whitney test (**)	-	<0,001**	0,336**	<0,001*	<0,001*

Districts. The highest levels of acute poisoning with alcohol-containing products in these subjects were recorded in the period from 2008 to 2014, followed by a decrease by 2020, a similar trend was traced in the Murmansk Region (Fig. 1). In the Nenets Autonomous District, there is a significant trend towards the decrease in the level of acute poisoning with alcohol-containing products, and in the Murmansk Region, the Yamalo-Nenets and Chukotka Autonomous Districts – there is a trend towards the change in the level of acute poisoning.

It should be noted that the most significant decrease in the level of acute poisoning (the average rate is -8.2%) is also observed in the Murmansk Region. The indicators of acute poisoning with alcohol-containing

products in the Yamalo-Nenets Autonomous District are characterized by an insignificant (1.5%) average growth rate, nevertheless, it was in this region that the lowest levels of acute poisoning among the studied territories were recorded throughout the study period.

Despite the relatively low level of poisoning with alcohol-containing products, the results of calculations show that in the analyzed subjects there is a high proportion of fatal poisonings: in the Murmansk Region - from 28.1% to 64.5%, in the Nenets Autonomous District - from 16.6% to 85.6%, in the Chukotka Autonomous District - from 25.3% to 91.6%, and in the Yamalo-Nenets Autonomous District - from 6.1% to 56.8%.

Rates of fatal alcohol poisoning in the Nenets

and Chukotka Autonomous Districts exceeded the national average, except for 2009 (the Chukotka Autonomous District) and 2019 (the Nenets Autonomous District). In the Murmansk Region, the indicator of fatal alcohol poisoning remains stable at the level of the Russian average, except for 2008, 2018 and 2020. Analysis of the averaged data for 2008-2020 indicators of fatal alcohol poisonings shows that in the Nenets and Chukotka Autonomous Districts the level of poisoning is statistically higher than the average for the Russian Federation, in the Yamalo-Nenets Autonomous District it is significantly lower, and in the Murmansk Region there are no statistically significant differences with the average Russian indicator (Table 2).

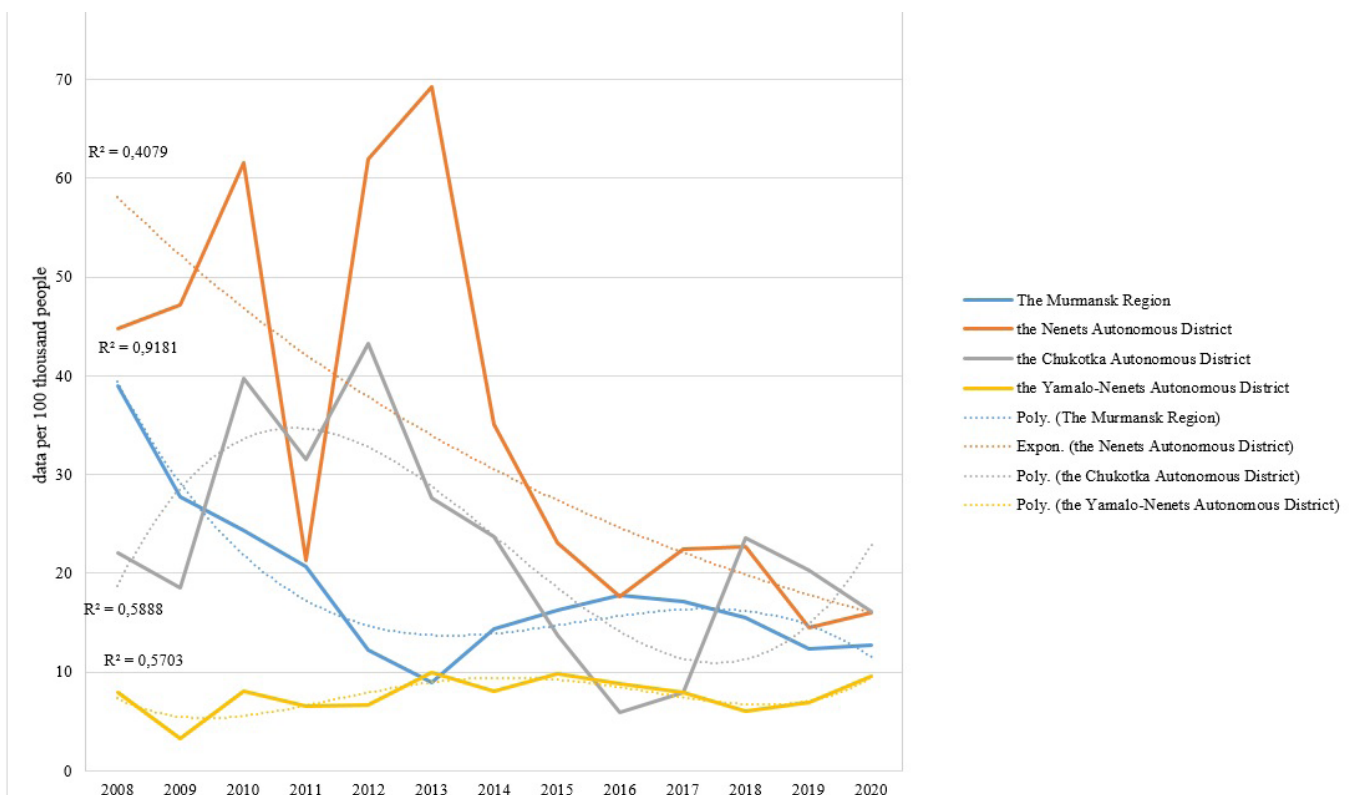


Figure 1. Dynamics of indicators of acute poisoning with alcohol-containing products (per 100,000 population) in the Murmansk Region, and the Autonomous Districts of Nenets, Chukotka and Yamalo-Nenets in 2008-2020.

Indicators of acute poisoning with alcohol-containing products with fatal outcome in 2008–2020 (per 100,000 population)

Year / statistics data	the RF	the Murmansk Region	the Nenets Autonomous District	the Chukotka Autonomous District	the Yamalo-Nenets Autonomous District
2008	12,5	16,2	35,4	18,1	0,7
2009	12,9	7,8	33,0	6,2	0,2
2010	12,4	10,3	30,8	31,3	0,5
2011	11,0	9,1	14,2	19,7	1,3
2012	10,1	4,9	19,0	29,5	0,6
2013	9,5	5,1	35,8	23,6	3,5
2014	9,7	8,3	14,0	21,7	4,6
2015	9,8	7,6	15,4	9,9	4,8
2016	8,9	8,8	12,5	3,9	4,5
2017	8,2	8,3	18,0	2,0	3,0
2018	7,8	10,0	11,4	19,7	1,7
2019	7,6	6,4	2,4	12,2	1,8
2020	7,3	7,5	13,7	14,1	5,0
Average growth rate (%)	-4,1	-5,8	-7,0	-1,9	16,3
Average value	9,8	8,2	19,3	16,3	2,4
95% (CI)	8,7-11,0	6,8-10,2	13,3-26,1	10,7-21,9	1,4-3,6
Median value	9,7	8,3	15,4	18,1	1,8
Midspread	8,0-11,7	7,0-9,6	13,1-31,9	8,1-22,7	0,7-4,6
Significance (p) of the Shapiro-Wilk criterion	0,304	0,033	0,080	0,837	0,072
Significance (p) of the T-test (*) or the Mann-Whitney test (**)	-	0,099**	0,006*	0,028*	<0,001*

In general, during the study period, in the Nenets and Chukotka Autonomous Districts, as well as in the Murmansk Region, there was a decrease in the level of fatal poisoning, and only in the Yamalo-Nenets Autonomous District an increased average growth rate was registered (16.3%). At the same time, it is in the Yamalo-Nenets Autonomous District that there is a significant trend towards the increase in acute

poisoning with alcohol-containing products with fatal outcome (Fig. 2), while in other regions there is either no significant trend towards the change in the dynamics of poisoning (the Chukotka Autonomous Okrug), or there is a pronounced trend towards the decrease in the level of this indicator (the Murmansk Region and the Nenets Autonomous District).

### Discussion

Indicators of fatal alcohol poisoning are more informative compared to the general level of acute poisoning, since in some territories there is an improper primary accounting of poisoning cases in medical organizations, as well as late provision of emergency notifications about cases of acute poisoning to the territorial bodies of Rosпотребнадзор. Therefore,

it can be confidently stated that the Nenets and Chukotka Autonomous Districts, characterized by a significant excess of the level of acute poisoning with alcohol-containing products with fatal outcome, are risk territories for this indicator.

At the same time, the reasons for the increased level of fatal cases need to be clarified, which may be due not only to the serious condition of patients caused by use of a large amount of alcohol or its surrogates, but also to the untimely provision of medical care, which is especially important in the hard-to-reach territories of the Nenets and Chukotka Autonomous Districts.

In addition, excessive alcohol consumption provokes an increased mortality rate from other external causes. A similar relationship can also be

traced in cases where we are talking about premature mortality from many other diseases, in the etiology of which the exogenous component is artificially enhanced [18]. In such connection it can be assumed that the real contribution of alcohol products acute poisoning to the overall mortality rate is significantly higher.

It seems relevant to study the levels of fatal alcohol poisoning not only in the territory of 4 analyzed subjects, but also in the remaining 5 subjects (the Republic of Karelia, the Republic of Komi, the Republic of Sakha (Yakutia), the Krasnoyarsk Territory and the Arkhangelsk Region), partially part of the Arctic zone of the Russian Federation. However, since the registration of deaths occurs at the place of death,

and not at the place of poisoning, the analysis of acute poisoning with fatal outcome in the context of municipalities included in the Arctic zone may give erroneous results. Registration of deaths at the place of residence can also lead to questionable results due to the potentially large number of residents temporarily staying in the Arctic territories, including those living in shift settlements, therefore, along with improving the primary accounting of acute poisoning that does not pose an immediate threat to life, it is necessary to supplement toxicological monitoring with information about the place of occurrence of acute poisoning with alcohol-containing products, including those with fatal outcome.

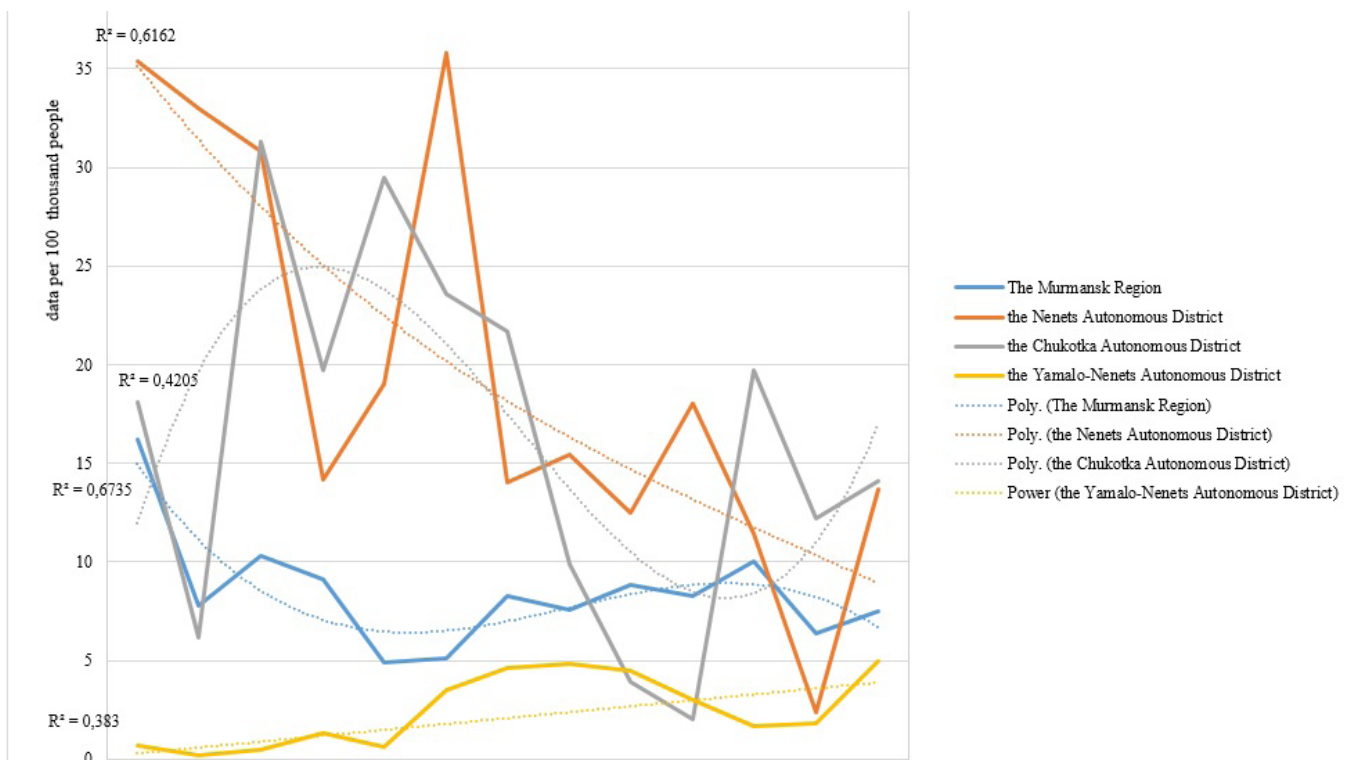


Figure 2. Dynamics of indicators of acute poisoning with alcohol-containing products (per 100,000 population) with fatal outcome in the Murmansk Region, and in the Autonomous Districts of Nenets, Chukotka and Yamalo-Nenets in 2008-2020.

## Conclusions

The analysis of toxicological monitoring data in 4 analyzed subjects for 2008-2020 revealed that the territories of trouble, in terms of fatal alcohol poisoning, are the Nenets and Chukotka Autonomous Districts, which are characterized by a statistically significant excess of the average levels of this indicator for 2008-2020 compared with the Russian Federation as a whole.

Despite the tendency towards the decrease in the indicators of acute alcohol poisoning in a number of regions, especially in the Nenets Autonomous District, in terms of fatal cases, this problem remains extremely relevant in these subjects, primarily in the territories of trouble, due to the high level of acute poisoning with fatal outcome.

Considering that the consumption of alcohol-

containing products in the Northern regions is traditionally high, it is necessary to improve the toxicological monitoring system aimed at improving the accounting of cases of acute poisoning with alcohol-containing products that do not pose an immediate threat to life and collecting information about the place of occurrence of acute poisoning.

## REFERENCES

1. On the approval of the Concept of the demographic policy of the Russian Federation for the period up to 2025: Decree of the President of the Russian Federation dated 09.10.2007 No. 1351. Access from the reference legal system «ConsultantPlus».
2. International classification of diseases of the 10th revision. Available at: <https://mkb-10.com/>. Link active as of 23 August 2021.
3. On the state of sanitary and epidemiological well-being of the population in the Russian Federation in 2020: State report. Moscow: Federal Service for Supervision of Consumer Rights Protection and Human Welfare, 2021.256 p.
4. Order of the Federal Service for Supervision of Consumer Rights Protection and Human Well-being of 320.10.2007 No. 305 «On Approval of the Form of Industry Statistical Observation».
5. Order of the Ministry of Health and Social Development of 196.10.2007 No. 656 «On Approval of the Administrative Regulations of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare on the performance of the state function of informing the state authorities of the Russian Federation, state authorities of the constituent entities of the Russian Federation, local authorities local government and population on the sanitary and epidemiological situation and on measures taken to ensure the sanitary and epidemiological well-being of the population. «
6. Litvinova O.S., Kalinovskaya M.V. Toxicological monitoring of causes of acute poisonings of chemical etiology in the Russian Federation. *Toxicological Review*. 2017;(1):5-9. (In Russ.). DOI: 10.36946/0869-7922-2017-1-5-9.
7. Musinova M.A., Krupnov N.M., Mordasova I.V. Chemical and toxicological monitoring of acute poisoning in the Ryazan region // *Forensic medicine*. - 2019. - T. 5. - No. S1.
8. Batievskaya VB, Khaes BB Dynamics and structure of acute poisoning in the Kemerovo region (KUZBASS) // *Natural resources of the Earth and environmental protection*. - 2020. - T. 1. - No. 7-9. - S. 62-65.
9. Serbina E.E. The results of toxicological monitoring of acute poisoning with alcohol-containing products in the Primorsky Territory for 2015-2019 // *Health Risk Analysis-2020 in conjunction with the international meeting on environment and health Rise-2020 and the round table on food safety*. - 2020. -- S. 357-359.
10. Loskutov D.V., Khamitova R.Ya. Dynamics of acute poisoning of chemical etiology in the Republic of Mari El // *International Journal of Applied and Fundamental Research*. - 2018. - No. 8. - S. 40-44.

11. Aydinov G.T., Marchenko B.I., Sineļnikova Yu.A. Acute chemical poisonings as an index of the system of socio-hygienic monitoring in the Rostov region. *Gigiena i Sanitaria (Hygiene and Sanitation, Russian journal)* 2018; 97(3): 279-285. (In Russ.). DOI: <http://dx.doi.org/10.18821/0016-9900-2018-97-3-279-285>. DOI: 10.18821/0016-9900-2018-97-3-279-285.
12. Varakina Zh.L., Vyazmin A.M., Sannikov A.L., Golenishcheva T.V., Plaksin V.A. Poisoning of the chemical etiology of children and adolescents in the city of Arkhangelsk and the main ways of their prevention. *Human ecology*. 2013; (1): 48-53.
13. Davletnurov N. Kh., Stepanov E. G. Analysis of the results of toxicological monitoring on the territory of the Republic of Bashkortostan for making managerial decisions on reducing the incidence and increasing life expectancy // *Labor Medicine and Human Ecology*. - 2018. - No. 1 (13).
14. Danilova E.V. Factors of formation and dynamics of the population of the Russian Arctic // *Modern Economy Success*. - 2020. - No. 6. - S. 154-159.
15. Information bulletin «The state of sanitary and epidemiological well-being of the population living in the Arctic zone of the Russian Federation, in 2019» / ed. d. m. n. S. A. Gorbaneva. - St. Petersburg, 2020 .-- 39 p.
16. Atlas of the sanitary and epidemiological situation in the Arctic zone of the Russian Federation (2017) / ed. d.m.s. S.A. Gorbaneva - St. Petersburg, 2017 .-- 52 p.
17. Methodological recommendations «On the preparation of materials for the state report» On the state of sanitary and epidemiological well-being of the population in the Russian Federation. «Methodical recommendations - Moscow: Federal Center for Hygiene and Epidemiology of Rospotrebnadzor, 2014 - 44 p.
18. Razvodovsky Y.E. Indicators of alcohol related problems in Russia, Ukraine and Belarus. *Narkologija [Narcology]* 2020; 19 (3): 39-48 (in Russian). DOI: 10.25557 / 1682-8313.2020.03.39-48.