HYGIENE, SANITATION, EPIDEMIOLOGY AND MEDICAL ECOLOGY

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COMPARATIVE ANALYSIS OF THE INDICATORS OF MILITARY POPULATION HEALTH IN CONTRAST CLIMATIC AND GEOGRAPHIC CONDITIONS

DOI 10.25789/YMJ.2021.76.15

УДК 614.1:[613.1+612.017+911.3]:359

Determination of certain diseases spread patterns in military population depending on geographical latitude, climate and heliocosmic factors is an urgent area of research. The aim of the study is to determine significant differences and establish patterns in the course of military population's health status comparative analysis in the Black Sea and Arctic regions. Materials and methods: Using statistical reports on form 3/med. for the period from 2013 to 2019, relative medical and statistical indicators characterizing of military personnel health state in the northern and southern latitudes were calculated. For comparative analysis, Student's t-test or Mann-Whitney test was used. Arithmetic averages with 95% confidence intervals (95% CI) were calculated to represent quantitative data. Dynamics analysis was carried out by calculation of growth indicators and polynomial trend of 2 degree with determination coefficient. Microsoft Excel 2016 and the IBM SPSS Statistics ver.28 were used for data processing. Results: Statistically significantly higher rates of primary incidence ($p=0.001$) and incidence with hospitalization ($p=0.045$) at high latitudes region were established. In the Northern Fleet, the share of respiratory diseases was 50.53%. Statistically significantly higher levels of mental disorders were established in the south ($p=0.016$), in high latitudes region - higher levels of VI ($p=0.001$), VIII ($p=0.027$), IX ($p<0,0001$), X ($p=0.026$), XI ($p<0,0001$), XIII ($p=0.001$) disease classes. Significant positive trends were noted for the military personnel incidence in the north with II ($R^2=0.7494$), X ($R^2=0.9192$), XIII ($R^2= 0.9353$), XIV ($R^2=0.722$) classes of disease. In the south, negative trends in the primary incidence of I ($R^2=0.8469$), IV ($R^2=0.838$) and VII ($R^2=0.724$) classes of disease were stable. Conclusions: The results of the study make it possible to conclude that there are significant differences in the health status of military populations in the Arctic and Black Sea regions due to a different combination of climatogeographic, heliocosmic and latitudinal factors. The Arctic region is characterized by both higher rates of primary morbidity in general and higher rates of X, XIII, XI, IX, VI and VII classes of diseases incident with a proportion in the overall primary morbidity structure of more than 50% by respiratory diseases.

Keywords: Far North; the military population state of health; the incidence of military personnel; Arctic region; Black Sea region.

Introduction. Depending on the geographical latitude, the angle of the sun's rays incidence determines the light, electromagnetic and temperature modes, which in turn form other environmental factors, such as atmospheric pressure, wind, the temperature of reservoirs and the earth's surface, humidity and other [4], which have a direct impact on the population health [5] and constitute the concept of "latitude factor" [2]. The angle of the sun, translated into Greek sounding as κλίματος [9], that is the base of the term "climate". Latitude and climate are inseparable concepts, but climate is a perennial combination of weather conditions in a particular area [9] and depends largely on the geographical characteristics of the area, while latitude is a concept of planetary scale, depending on the planet axis of rotation position in relation to the Sun. In the works of Yu.G. Solonin, it was proved that in similar climatogeographic conditions, differing only a few degrees of geographical latitude, there are significant differences in the level of population physical health [15].

A number of researchers published data confirming the presence of an association between latitude factor and sleep duration [17], prevalence of various diseases such as depression [21], multiple sclerosis [20], breast cancer [22], dementia [18], acute respiratory viral infections, including COVID-19 [19, 24], cardiovascular diseases [10]. As probable reasons, excess or lack of solar radiation is given, which itself has a damaging effect [22] and indirectly causes decreasing vitamin D content with its deficiency [18 – 21, 24] or vitamin B12 - with excess [23], as well as fluctuation of the Earth's electromagnetic field [10]. Thus, the latitude factor is significant for human health and should be taken into account on an equal basis with climatogeographic conditions [14].

Contracted military personnel are a specific population with a special epidemic processes and structure of diseases, which makes it impossible to interpolate the results of studies involving the civilian population into this category.

The aim of the study is to determine significant differences and establish patterns of the military population health status in the Arctic and Black Sea regions by the course of a comparative analysis

Methodology and materials. The headquarters of the Russian Federation Navy fleets were analyzed with obtained from open sources the deployment areas geographical components for determining comparison sample sets. The most optimal for comparison were the military populations of the Northern and Black Sea fleets, located at the same longitude and significantly remote in latitude.

Statistical reports containing information about compared military populations state of health in form 3/med for the period from 2013 to 2019 were processed for the study. Medical and statistical indicators of incidence (primary morbidity, general morbidity, hospitalization rate, incidence with temporary disability (ITD) per 1000 people for each year studied and on average [3] was calculated. The nosological pattern of morbidity was assessed in accordance with the international classification of diseases (ICD) of the 10th revision [8], dental morbidity and XV-XVIII classes of diseases were not taken into account (Table 1).

To determine the dynamics of incidence indicators, the average absolute increase (AAI) and the growth rate for the period (GR) were calculated, graphs were plotted with subsequent data equalization by calculating the polynomial

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Table 1

Classes of ICD-10 diseases used in comparative analysis of military populations health

Class	Title
I	Certain infectious and parasitic diseases
II	Neoplasms
III	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
IV	Endocrine, nutritional and metabolic diseases
V	Mental and behavioural disorders
VI	Diseases of the nervous system
VII	Diseases of the eye and adnexa
VIII	Diseases of the ear and mastoid process
IX	Diseases of the circulatory system
X	Diseases of the respiratory system
XI	Diseases of the digestive system
XII	Diseases of the skin and subcutaneous tissue
XIII	Diseases of the musculoskeletal system and connective tissue
XIV	Diseases of the genitourinary system
XIX	Injury, poisoning and certain other consequences of external causes

trend of the 2nd degree and the determination coefficient (R^2) to estimate the trend severity.

For the comparison of the total health status, the health coefficient (CH) [16] was calculated using the formula CH = (I*100)/(I+2*II+3*III), where I is the proportion of people with health group I (healthy people) in %, II is the proportion of people with health group II (relatively healthy people) in %, III is the proportion of people with health group III (with chronic diseases) in %, 2 and 3 are the "severity" ratios.

After checking the normality of the data distribution, parametric (Student's t-test) or non-parametric (Mann-Whitney U-test) methods of statistics were used. Compared parameters having statistically significant differences in tables are highlighted by *.

Extensive values were mapped using an arithmetic mean with a 95% confidence interval (95% CI) or a percentage in the structure.

Microsoft Excel 2016 and IBM SPSS Statistics ver.28 software capabilities were used for statistical data operations.

Results and discussion. The cities with Main Offices of the compared military units has greatest climatic characteristics differences in the average annual temperature, atmospheric pressure and in the amount of sunshine (Table 2). The location of the responsibility zone of the Northern Fleet on the territory of the Arctic zone of the Russian Federation is an important factor, which determines the impact of adverse climatogeographic and heliocosmic factors of the region in complex to the military population.

The incidence rate with hospitalization is not an environmentally friendly indicator, therefore, the differences identified are primarily due to the organizational aspects of medical care and may not be taken into account in the analysis of the environmental factors impact to the military personnel health.

The primary morbidity rate is an indicator of the population physical health level. In the study of VYu Semenov, higher levels of primary morbidity were established in high latitudes in almost all classes of diseases, with the exception of the circulatory system and cerebrovascular diseases pathology [11]. Significantly higher level of primary incidence among the military personnel in the Arctic region (AR) in comparison with Black Sea (ChR) found in this research and confirms results of other researchers about existence of correlation between the geographic latitude and physical human health [10, 13, 14] that allows to draw a conclusion about

Table 2

The Main Offices of the compared military units basing areas climatic parameters on average per year, abs.

Criteria	Severomorsk	Sevastopol
Temperature	- 0,2° C	+12,2° C
Atmospheric pressure	753 mm Hg.	662 mm Hg.
Amount of precipitation	475 mm.	393 mm.
Humidity	78%	72-74%
Wind speed	4,2 m/s	4,3 m/s
Sun radiance	<1700 hours (2,9 kWh/sq.m)	2342 hours (4,14 kWh/sq.m)

Table 3

The medical and statistical indicators of military populations health status in comparison for the period from 2013 to 2019, ‰ (95% CI)

Relative indicators	Arctic region	Black Sea region	Results, importance, abs.
Primary incidence *	474.73 (422.65-526.80)	199.09 (118.73-279.46)	U=0.000; p=0.001
General incidence	971.95 (935.11-1008.79)	1009.45 (583.90-1435.01)	t=-0.215; p=0.837
ITD	3729.83 (3508.47-3951.19)	4262.82 (3000.98-5524.67)	t=-1.018; p=0.346
Incidence with hospitalization *	159.07 (133.56-184.58)	220.19 (158.59-281.78)	t=-2.243; p=0.045
Mortality per 100 thousand people.	107.71 (90.81-124.61)	89.29 (48.06-130.52)	t=1.012; p=0.332
Health dismissal rate	9.15 (7.37-10.93)	7.62 (5.15-10.08)	U=22.00; p=0.805
Health coefficient	41.66 (38.06-45.26)	42.06 (29.11-55.01)	U=13.00; p=0.165

Table 4

Incidence of different classes pathology in compared military populations for 2013-2019, ‰ (95% CI)

Relative indicators	Arctic region	Black Sea region	Results, importance, abs.
Class I	6.46 (5.17-7.76)	6.07 (1.71-10.43)	t=0.212; p=0.836
Class II	4.23 (3.49-4.96)	4.84 (3.71-5.99)	t=-1.125; p=0.286
Class III	0.49 (0.28-0.71)	0.64 (-0.13-1.4)	U=19.00; p=0.535
Class IV	5.22 (4.34-6.11)	6.19 (0.95-11.44)	t=-0.447; p=0.670
Class V*	1.74 (1.32-2.17)	3.24 (2-4.49)	t=-2.787; p=0.016
Class VI*	15.81 (13.39-18.23)	8.6 (6.73-10.47)	U=0.00; p=0.001
Class VII	12.07 (10.78-13.37)	12.61 (1.61-23.61)	U=14.00; p=0.209
Class VIII*	10.55 (10.01-11.1)	7.59 (5.08-10.1)	t=2.824; p=0.027
Class IX*	27.38 (25.15-29.61)	10.7 (7.41-13.98)	t=10.282; p<0.0001
Class X*	235.89 (205.75-266.03)	86.77 (-7.94-181.47)	U=7.00; p=0.026
Class XI*	28.14 (24.28-32.0)	14.21 (8.4-20.01)	t=4.892; p<0.0001
Class XII	30.58 (27.54-33.63)	28.77 (15.67-41.87)	U=13.00; p=0.165
Class XIII*	63.39 (49.09-77.7)	29.43 (17.89-40.96)	t=4.522; p=0.001
Class XIV	13.2 (11.43-14.97)	13.26 (9.46-17.07)	t=-0.037; p=0.971
Class XIX	11.68 (11.33-12.03)	11.32 (9.23-13.42)	U=19.00; p=0.535

the importance of a latitude factor for this military population health indicator.

In the average over the study period structure of the military population primary incidence in the northern latitudes, more than 5% were diseases of X (50.53%), XIII (13.58%), XII (6.56%), XI (6.02%) and IX (5.87%) classes, other types of pathology had a smaller contribution. In the Black Sea region, X (35.53%), XIII (12.05%), XII (11.78%), XI (5.82%), XIV (5.43%) and VII (5.16%) disease classes became the most significant from the same position.

Statistically significantly higher levels of mental disorders in the south, while statistically significantly higher levels of VI, VIII, IX, X, XI and XIII diseases classes at high latitudes were established in comparison of mean primary incidence rates over the analyzed period (Table 4).

When estimating the dynamics of primary incidence rates over the study period (Table 5), statistically significant positive trends were noted for incidence among military personnel in Arctic region conditions for II, X, XIII and XIV disease classes.

In the military population of the Black Sea region (BSR), negative trends in primary incidence for I, IV and VII classes of diseases were stable.

The absence of primary incidence rates long-term dynamics in V, VIII and IX diseases classes, as well as the presence of a statistically significant difference between them in the compared populations, allow us to conclude that the differences can only be due to the influence of environmental factors.

Table 5

Indicators of primary incidence dynamics by ICD-10 classes in the compared military populations for the period 2013-2019

Classes		AAI, ‰	GR, %	Polynominal trend equation, R^2
I	AR	0.26	31.77	$y= -0.1958x^2 + 1.9727x + 2.49$, $R^2=0.6696$
	BSR	-1.94	-77.67	$y= 0.5059x^2 - 5.8553x + 19.373$, $R^2=0.8469$*
II	AR	0.18	30.3	$y= -0.0087x^2 + 0.3863x + 2.8543$, $R^2=0.7494$*
	BSR	-0.06	-5.89	$y= 0.2031x^2 - 1.6645x + 7.445$, $R^2=0.3854$
III	AR	0.05	75.0	$y= 0.0152x^2 - 0.0398x + 0.3471$, $R^2=0.6498$
	BSR	-0.08	-60.37	$y = -0.0431x^2 + 0.2186x + 0.6253$, $R^2=0.1459$
IV	AR	0.39	61.44	$y= -0.0212x^2 + 0.4924x + 3.6771$, $R^2=0.5403$
	BSR	-1.32	-45.96	$y= 1.2348x^2 - 10.973x + 25.391$, $R^2=0.838$*
V	AR	-0.07	-19.47	$y= 0.0407x^2 - 0.3414x + 2.2957$, $R^2=0.1162$
	BSR	0.18	38.35	$y= 0.1269x^2 - 1.1422x + 5.275$, $R^2=0.1656$
VI	AR	0.21	10.02	$y= -0.494x^2 + 4.1324x + 9.16$, $R^2=0.5204$
	BSR	-0.12	-7.35	$y= 0.2862x^2 - 2.6434x + 13.449$, $R^2=0.4216$
VII	AR	0.13	6.89	$y= -0.1785x^2 + 1.3315x + 10.317$, $R^2=0.2496$
	BSR	-5.14	-82.71	$y= 1.3428x^2 - 14.809x + 44.995$, $R^2=0.724$*
VIII	AR	-0.05	-2.74	$y= 0.0602x^2 - 0.4333x + 11.083$, $R^2=0.1755$
	BSR	0.3	31.62	$y= -0.3475x^2 + 2.7099x + 3.6986$, $R^2=0.2325$
IX	AR	0.72	16.53	$y= 0.1943x^2 - 0.7843x + 26.629$, $R^2=0.5663$
	BSR	0.83	54.91	$y= 0.1202x^2 - 0.4711x + 10.179$, $R^2=0.1051$
X	AR	11.75	38.22	$y= -4.039x^2 + 44.97x + 136.79$, $R^2=0.9192$*
	BSR	-44.79	-90.21	$y= 10.521x^2 - 117.71x + 347.19$, $R^2=0.6485$
XI	AR	0.92	22.47	$y= -0.3612x^2 + 4.326x + 18.061$, $R^2=0.658$
	BSR	2.04	110.38	$y= 0.424x^2 - 1.9365x + 13.476$, $R^2=0.3151$
XII	AR	-0.2	-4.39	$y= -0.5277x^2 + 3.5887x + 26.784$, $R^2=0.5335$
	BSR	-0.56	-13.64	$y= -1.4496x^2 + 10.867x + 14.294$, $R^2=0.1591$
XIII	AR	5.81	81.48	$y= -0.6602x^2 + 12.112x + 28.149$, $R^2=0.9353$*
	BSR	-1.97	-25.06	$y= 1.4358x^2 - 13.803x + 55.921$, $R^2=0.3463$
XIV	AR	0.61	37.23	$y= -0.249x^2 + 2.6095x + 7.7443$, $R^2=0.722$*
	BSR	-0.09	-3.66	$y= 0.1919x^2 - 2.2115x + 18.272$, $R^2=0.1567$
XIX	AR	0.04	1.8	$y= 0.016x^2 - 0.0262x + 11.463$, $R^2=0.3598$
	BSR	0.62	43.4	$y= -0.296x^2 + 3.0496x + 5.0466$, $R^2=0.6585$

The low amount of Sun energy reaching the surface of the planet in the Far North regions, covered with ice and snow, causes low ambient temperatures, which in turn are the reason for the low absolute humidity of the atmosphere. Inhalation of dry cold air causes a cascade of reactions in the lungs of human similar to transpiration and complicated by sorption hysteresis, leading to pulmonary edema, impaired oxygen transport through the surface of the alveoli, the development of fibrous changes, and drying of the upper respiratory tract mucous membrane makes it vulnerable to the penetration of pathogens of various infectious diseases [13]. This explains the fact that respiratory diseases in military personnel in Arctic conditions accounted for more than half of the total structure of primary morbidity and were almost three times higher than among military personnel in the Black Sea region.

Another important consequence of the low angle of sunlight at high latitudes is the deficiency of ultraviolet light, which causes a lack of vitamin D in the human body, which can cause the known list of pathology [7]. Significantly low levels of this vitamin in the Far North were established at military personnel in earlier studies by other authors [1].

A complex of factors that increase morbidity in the VI, VIII, IX, XI, XIII classes of diseases, which in this study showed significantly higher levels of primary morbidity in military personnel in the Arctic Region compared to the Black Sea region, are: the special nature of the Earth's geomagnetic field at high latitudes, affecting the electrical function of endotheliocytes, heart, tissue respiration function, conductance of nerve pulses; low ambient temperatures, causing hyperstimulation of the catecholamine system and spasm of vessels on the periphery, desynchronization of thyroid and pancreatic hormone production; desynchronoses caused by impaired melatonin production as a result of specific photoperiodism [6]; sharp differences in atmospheric pressure, accompanied by fluctuations in the partial pressure of oxygen in the air and capable of leading to hypoxic hypoxia [12]. Therefore, it allow us to conclude that the influence of environmental conditions Far North region on both the civilian population [11 – 14] and military personnel is similar.

Conclusions. The results of the study make it possible to conclude that there are significant differences in the health status of military populations in the Arctic and Black Sea regions due to a different combination of climatogeographic, heliocosmic and latitudinal factors.

The Arctic region is characterized by a higher rate of primary morbidity in both the general and X, XIII, XI, IX, VI and VIII classes of diseases with a proportion of respiratory diseases in the common primary morbidity structure of more than 50%.

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ASSESSMENT OF THE IMPACT OF INVASIVE INTERVENTIONS ON THE RISK OF URINARY TRACT INFECTIONS ASSOCIATED WITH THE PROVISION OF MEDICAL CARE IN PATIENTS OF OLDER AGE GROUPS ON THE EXAMPLE OF THE LARGE MULTIDICSIPLINARY HOSPITAL IN ALTAI KRAI

DOI 10.25789/YMJ.2021.76.16

УДК 616.62:613.5

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In order to assess the impact of invasive interventions on the prognosis of urinary tract infections (UTIs) associated with the provision of medical care among patients of older age groups 700 case histories of patients over 65 years of age were selected. Using the method of discriminant analysis the indicators of invasive interventions, surgical intervention were analyzed as well as the combination of these indicators with the most common somatic diseases that were identified among patients at risk of developing UTIs associated with medical care.

Keywords: urinary tract infections, infections associated with medical care, invasive interventions, epidemiology, morbidity, risk factors.

Introduction. Urinary tract infections occupy the second place among infectious diseases in the structure of infections associated with the provision of medical care (ISMP) of patients after respiratory tract diseases [1, 2]. Most hospital UTIs in patients of older age groups are complicated because they occur in patients with various somatic diseases (diabetes mellitus, immunodeficiency conditions), as well as in connection with the use of invasive methods of examination and treatment [3, 4, 5].

Endogenous infection of the urinary tract is associated with natural contamination of the external urethra and with various diagnostic transurethral manipulations, the introduction of microorganisms into the bladder is possible [6, 7]. Exogenous nosocomial infection occurs from patients with acute and chronic UTIs and from the hospital environment. The main places of infection with UTIs associated with the provision of medical care are dressing and cystoscopic rooms, wards (in the case of dressing patients in them and using open drainage systems) [8, 9, 10].

The aim of the study was to evaluate the impact of invasive interventions on the prognosis of UTI related to medical care among patients of older age groups.

Materials and methods

In the period from 2007-2019, 700 case histories of patients over 65 years of age were selected. In order to evaluate invasive interventions for the prognosis of the development of UTIS associated with the provision of medical care using the method of discriminant analysis (the IBM SPSS 23 statistical computer package was used), a prognostic function was built for patients of older age groups, in the calculation of which only the indica-