UDC [613.68 : 616–057.36] : [355.511.512 : 355.332]

MAIN HEALTH INDICATORS IN THE MILITARY WHO SERVED ON A CONTRACT BASIS IN THE RUSSIAN NAVY IN 2003–2016

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We selectively carried out statistical medical reports by Form 3/MED in the military units with about 60% of the total number of sailors and foremen who served on a contract basis in the Russian Navy from 2003 to 2016. Over 14 years in the sailors and foreman who served on a contract basis, average annual overall morbidity rate was 870.8 ± 73.5‰, and primary morbidity rate 378.4 ± 20.3‰, the need for dynamic follow-up care 88.2 ± 11.4‰, hospital admission 197.2 ± 10.2‰, days away from work (3866 ± 213) ‰, dismissal for health reasons 6.29 ± 0.32‰. The mortality rate was 111.8 ± 11.8 deaths per 100 thousand military per year. Polynomial trends of the listed indicators with determination coefficients of varying significance revealed reducing trend.

Compared with all the military who served by contract in the Russian Navy, the sailors and foremen had a statistically significant lower rate of primary morbidity hospitalizations and a higher rate of dismissal due to health reasons.

Diseases and injuries from 6 categories (IX, X, XI, XII XIII and XIX) by International Statistical Classification of Diseases and Health Problems of the 10th revision accounted for 76.8% of the overall structure of health disorders. These health disorders are of high military-epidemiological significance for contract military personnel of the Russian Navy, including injuries and other consequences of external causes (XIX) – 25%, respiratory diseases (X) – 18.3% and cardiovascular diseases (IX) – 14.3%. Measures to prevent such diseases and injuries will contribute to improving the health of the military who served by contract.

Keywords: marine medicine, military medicine, serviceman, sailor, foreman, service on a contract basis, health, morbidity, hospitalization, dismissal, mortality.

Introduction. In recent years, the increasing of representation of contract enlisted servicemen in the Russian Armed Forces and of the sailors and sergeants who served on a contract basis in the Russian Navy was marked. In contrast with contract enlisted servicemen

of other branches of military service the sailors and foremen who served on a contract basis in the Navy had to carry out special missions of complex technologies maintenance under high mental and physical loads, high price for the mistakes and personal responsibility for the whole company fate [1, p. 90–92].

The survey held has shown that listed above factors resulted in disorders in processes of social and psychological adaptation and development of various types of deviant behavior in the sailors and foremen who served on a contract basis [Soshestvensky V.Yu.[1]; 2, p. 65]. In order to prevent these events, great attention was paid to medical maintenance and psychological follow-up in the Russian Navy military: methods of assessment and prediction of professional efficiency are developed and improved, new approaches for occupational selection and psychological follow-up and correction of influence of military activity factors on health status are implemented [Vinokurov V.L.[2]; Mosyagin I.G.[3]; 3, p. 19–20; 4, p. 64–65]. Alongside this, battle skill training and physical endurance had been improved [5, p. 84, 88; 6, p. 76–78], as well as process of professional health maintenance had been-optimized.

In spite of listed above measures, health status of the military in the Russian Navy during the service period was getting worse. Given the situation, there is a plausible case that for development of effective preventive measures it is necessary to use another method – assessment of risk to the health impacted by unfavorable factors with the following minimization of these risks by means of preventive measures.

Under the implementation of this method, at the first stage it is necessary to determine the direction of disorders in health status of the military who served on a contract basis in the Russian Navy. Then later it is possible to compare detected health disorders induced by present social, professional and personal factors with the same indicators in the military servicemen who wasn't impacted with hazards specific to the Navy (for instance, in the military of the Army or in working-age population of Russia). Basing on additional risks

[1] Soshestvensky V.Yu. Pedagogical prophylactic of deviant behavior in the Navy units military who served by contract: author's abstract. ... PhD Ped. Moscow, 2008. 24 p. [Soshestvenskii V.Yu. Pedagogicheskaya profilaktika otklonyayushchegosya povedeniya voennosluzhashchikh po kontraktu chastei VMF : avtoref. dis. ... kand. ped. nauk. Moscow, 2008, 24 p. (In Russ.)].

[2]Vinokurov V.L. Social and hygienical health aspects for the military of Russia's Black Sea Fleet who served by contract and the ways of health disorders prevention: author's abstract. ... PhD Med. Kursk, 2004. 16 p. [Vinokurov V.L. Sotsial'no-gigienicheskie aspekty sostoyaniya zdorov'ya voennosluzhashchikh Chernomorskogo flota RF, prokhodyashchikh sluzhbu po kontraktu, i puti profilaktiki ego narushenii : avtoref. dis. ... kand. med. nauk. Kursk, 2004. 16 p. (In Russ.)].

[3]Mosyagin I.G. Psychophysiological regularities of naval specialists adaptation: author's abstract of ... PhD Med. Arkhangelsk, 2007. 31 p. [Mosyagin I.G. Psikhofiziologicheskie zakonomernosti adaptatsii voenno-morskikh spetsialistov : avtoref. dis. ... d-ra med. nauk. Arkhangel'sk, 2007, 31 p. (In Russ.)]

values, it is possible to reveal prior directions of disease prevention measures and make the best use of present resources for maintenance of health in the Russian Navy military.

Unfortunately, solving this issue is beyond our abilities but we hope that medical-statistical study of the first stage will be continued by other military-medical specialists. We express our confidence that our colleagues will reveal the main risks and find the ways to correct the negative disorders in the health of sailors and foremen in the Russian Navy.

The purpose of the study: to study medical-statistical morbidity rates in the military who served on a contract basis in the Russian Navy in 2003–2016.

Materials and methods. We selectively carried out statistical analysis of medical data reported by Form 3/MED in the military units with about 60% of the total number of the sailors and foremen who served on a contract basis in the Russian Navy in 2003- 2016 [7, p.16].

We have analyzed generally used medical-statistical indicators of health in the military who served on a contract basis by International Statistical Classification of Diseases and Health Problems of the 10th revision (ICD-10) (Table 1): overall morbidity (medical help sought), primary morbidity, the need for dynamic follow-up care, admission to hospital (hospitalization treatment), days away from work, dismissal for health reasons, and mortality [8, p. 26].

Table 1

Classes of diseases and causes of death accepted in IDC-10

Class	Name of a class	Code
I	Certain infectious and parasitic diseases	A00–B99
II	Neoplastic diseases	C00–D48
III	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	D50–D89
IV	Endocrine, nutritional and metabolic diseases	E00–E90
V	Mental and behavioural disorders	F00–F99
VI	Diseases of the nervous system	G00–G99
VII	Diseases of the eye and adnexa	H00–H59
VIII	Diseases of the ear and mastoid process	H60–H95
IX	Diseases of the circulatory system	I00–I99
X	Diseases of the respiratory system	J00–J99
XI	Diseases of the digestive system	K00–K93
XII	Diseases of the skin and subcutaneous tissue	L00–L99
XIII	Diseases of the musculoskeletal system and connective tissue	M00–M99
XIV	Diseases of the genitourinary system	N00–N99
XIX	Injury, poisoning and certain other consequences of external causes	S00–T98

We have calculated morbidity rates were calculated for 1000 of the military or in %, the mortality rate – for 100 thousands of the military who served by contract using for comparison the data on mortality of working-age population of Russia from the site of the Federal State Statistics Service (Rosstat) [http://www.gks.ru/].

Mean arithmetic rates and their statistical errors M±m are represented below. Taking into account that data obtained for the military who served by contract in the Russian Navy [9, p. 15] are the part of overall data, the rates of all men who served by contract in the Armed Forces were used to determine similarities (differences). We assessed dynamics and prediction of the health indicators by means of analysis of dynamic ranges and calculation of polynomial trends of the second order.

We considered essential percentage in morbidity indicators as 4.5% and more and calculated the overall index of health disorders. For the diseases class structure, mortality contribution was multiplied by coefficient 3, dismissal contribution – by coefficient 2, other data contribution - by coefficient 1. Basing on the obtained total sum of the structural data, the full-scale index of health disorders in military who served by contract was calculated.

Results and discussion

***Overall morbidity*.** Average annual morbidity of the military who served on a contract basis from 2003 to 2016 was rated as 870.8±73.5‰, i.e. almost each sailor and foreman served by contract had sought treatment. All the military who served by contract in the Russian Armed Forces represented greater overall morbidity rate at the trend level – 1032.1±38.0‰ under $p<0.1$. Polynomial trend of overall morbidity under high determination coefficient ($R^2=0.83$) represents increasing in the data (Figure 1).

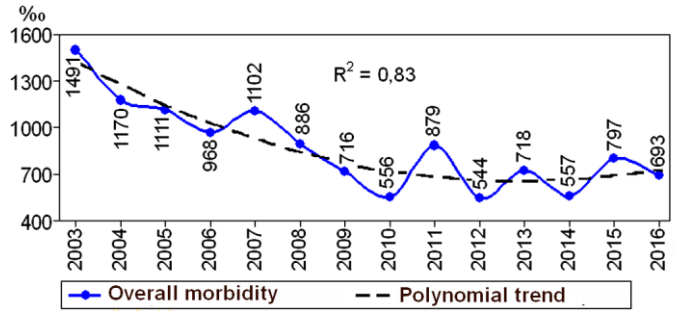

Fig. 1. Overall morbidity rate in the military who served by contract

The highest rates of overall morbidity were marked in the sailors and foremen who served by contract in the Russian Navy with X, XII and XIII classes of diseases: 373.5±28.3, 85.3±10.8, and 80.4±5.0‰ respectively. In all the military servicemen who served by contract in the Armed Forces of Russia, rates of overall morbidity were 435.7±20.6, 149.3±11.5 and 105.0±8.4‰ [9, p. 9]. Rate of overall morbidity in the sailors and foremen was statistically significant less in XII ($p<0.001$) and XIII ($p<0.01$) classes of diseases.

Polynomial trends of indicators of main classes with different determination coefficients show reducing the rate of overall morbidity in the sailors and foremen who served by contract with X ($R^2=0.69$) and XII ($R^2=0.91$) classes of diseases and increasing tendency in those with XIII ($R^2=0.56$) class.

It was found that a sum of rates of 6 classes of diseases (IX, X, XI, XII, XIII and XIX) had been 81.6% of overall morbidity structure including rates by X class – 43% (Fig.2). Reducing of a fraction in dynamics of overall morbidity structure is marked in the military with XII and XIX classes of diseases, stability – in the servicemen with X and XI classes, and increasing trend – in the servicemen with IX and XIII classes (Fig.2).

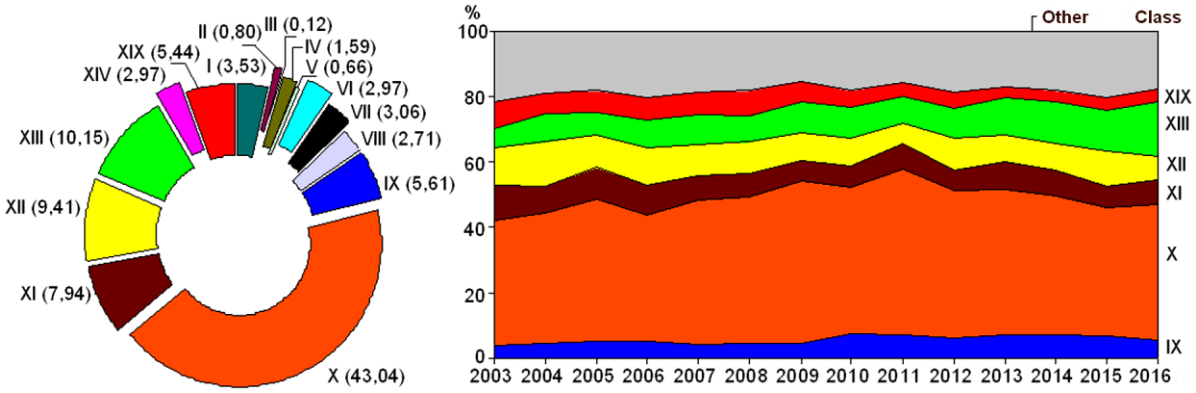

Fig. 2. Structure of overall morbidity rate (on the left) and dynamics of the structure (on the right) in the military who served by contract

Primary morbidity. Average annual rate of primary morbidity in sailors and foremen who served on a contract basis in the Russian Navy in 2003-2016 was 378.4±20.3‰, i.e. almost every third serviceman was diagnosed with a new disease. In all military servicemen who serve by contract in the Armed Forces of Russia primary morbidity rates were statistically significant higher: 489.3±13.2‰ under $p<0.010$. Polynomial trend of primary morbidity in the sailors and foremen who served on a contract basis with significant determination coefficient ($R^2=0.78$) reveals reducing trend (fig.3).

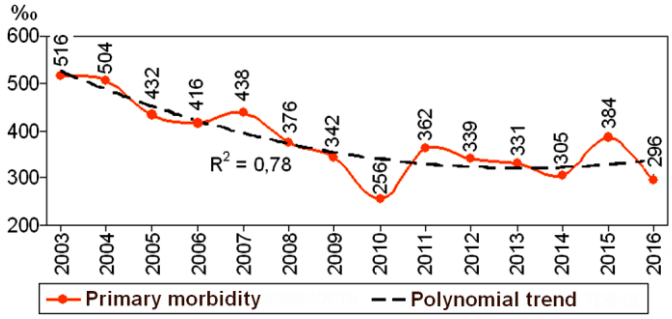

Fig. 3. Primary morbidity rate in the military who served by contract

The highest data of primary morbidity were marked in the sailors and foremen with X, XII and XIII classes of diseases: 173.8±9.0, 34.4±2.4 and 31.7±2.0‰ respectively. In all military men who served by contract in the Armed Forces of Russia primary morbidity rates were 221.5±9.6, 64.9±4.1 and 46.0± 4.1‰ respectively [9, p. 18, 20]. Rate of primary morbidity in the sailors and foremen was statistically significant less in X and XII classes ($p<0.001$ for both classes) and in XIII ($p<0.01$) class of diseases.

Polynomial trends of the listed indicators with determination coefficients of varying significance revealed reducing trend of primary morbidity in the sailors and foremen who served by contract with X (R2=0.66) and XII (R2=0.79) classes of diseases and increasing trend – in those with XIII (R2=0.35) class of diseases.

It was found that a sum of rates of 6 classes of diseases (IX, X, XI, XII, XIII and XIX) had been 82.1% of overall primary morbidity structure including rates by X class – 45.8% (Fig.4). Reducing of a fraction in dynamics of the rate of primary morbidity structure is marked in the sailors and foremen who served by contract with XIX class of diseases, stability – in servicemen with X, XI and XII classes, and increasing trend – in the servicemen with IX and XIII classes (Fig.4).

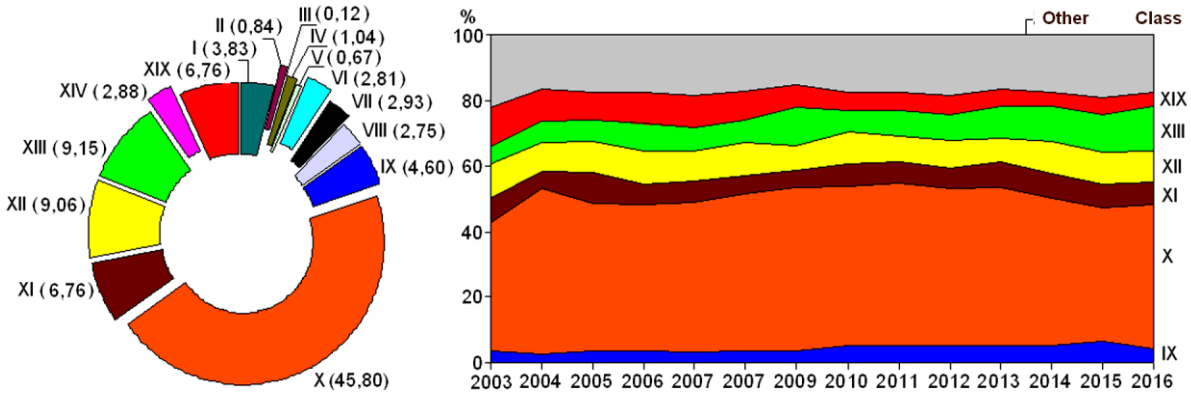

Fig. 4. Structure of primary morbidity rate (on the left) and dynamics of the structure (on the right) in the military who served by contract

Follow-up care. Average annual rate of need for dynamic follow-up care in the sailors and foremen who served on a contract basis in the Russian Navy was 88.2±11.4‰, that at trend level was more (p>0.05) than in overall number of drafting military personnel in the Armed Forces of Russia – 78.2±5.1‰. Polynomial trend of follow-up rate with significant determination coefficient (R^2=0.74) reveals reducing trend (Fig.5).

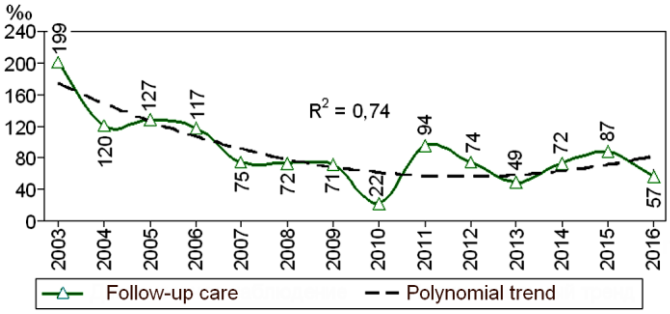

Fig. 5. Follow-up rate in the military who served by contract

The highest indicators of follow-up care were marked in the sailors and foremen with IX, X and XI classes of diseases – 11.5±1.8. 18.7±1.8 and 19.2±3.5‰ respectively. In all military servicemen who served by contract in the Armed Forces of Russia the follow-up rates were almost the same: 10.5±0.8. 20.1±2.2 and 15.5±1.3‰ respectively [9, p. 28, 30].

Polynomial trends of the listed indicators with determination coefficients of varying significance revealed reducing trend of follow-up in the sailors and foremen who served by contract with IX (R^2=0.55), X (R^2=0.83) and XII (R^2=0.33) classes of diseases.

It was found that 8 classes of diseases (I, IV, VI, IX, X, XI, XIII и XIV) each of 4.5 and more % of contribution defined 85.3% of follow-up structure (Fig.6). Reducing of a fraction in dynamics of follow-up rate structure is marked in the sailors and foremen who serve by contract with I, VI, X, XI, XII classes of diseases, stability – with XIV class, increasing – with IV and IX classes (Fig.6).

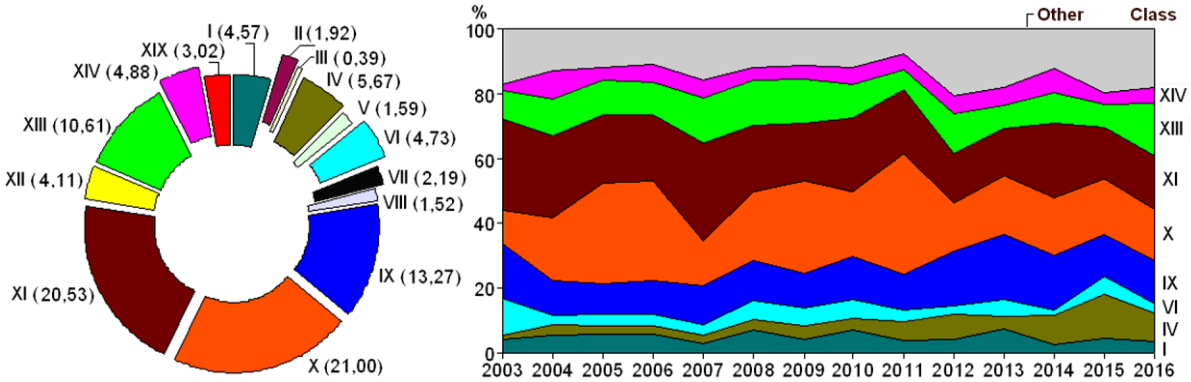

Fig. 6. Structure of follow-up rate (on the left) and dynamics of the structure (on the right) in the military who served by contract

Hospital admission. Average annual rate of hospital admission in the sailors and foremen who served by contract in 2003-2016 was 197.5±10.2‰. In all military servicemen who served by contract in the Armed Forces of Russia the hospital admission rate was statistically significant higher – 236.±7.‰ under p<0.01. Polynomial trend of hospital admission rate with low determination coefficient (R2=0.2) reveals reducing trend (Fig.7).

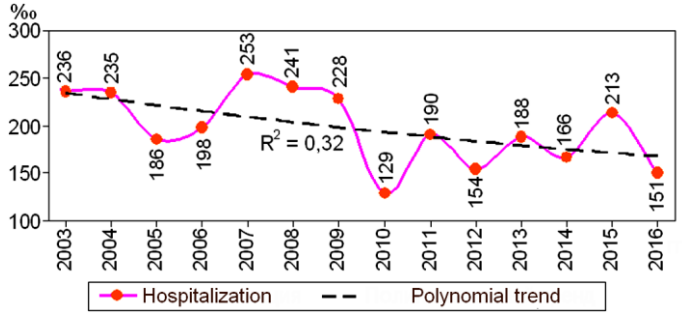

Fig.7. Follow-up rate in the military who served by contract

16.2% of sailors and foremen who served on a contract basis in the Russian Navy were treated in sick bays, 83.3% - in hospitals, 0.5% - in other health centers. In comparison with all military who served by contract in the Armed Forces of Russia the number of sailors and foremen hospitalized in sick bays was less while in hospitals – more (p<0.001).

The highest rates of hospital admission were marked in the sailors and foremen who served by contract with X, XI and XIX classes of diseases and traumas – 67.9±6.5, 19.8±1.3 and 18. ±1.8 ‰ respectively. In drafted military in the Armed Forces of Russia the rates for

the indicated classes were 97.5±3.9, 21.5±0.8 and 13.2±0,9‰ respectively [9, p. 37–38]. Hospital admission rate in the sailors and foremen was significant less in 10 class of disease ($p<0.01$) and more – in XIX class of traumas ($p<0.05$).

Polynomial trends of the listed above main classes with determination coefficients of varying significance revealed reducing trend of hospital admission rate in the sailors and foremen who served by contract with X (R2=0.31), XI (R2=0.64) and XIX (R2=0.78) classes of diseases and traumas.

It was found that 8 classes of diseases and traumas ((I, IX, X, XI, XII, XIII, XIV and XIX), each of more 4.5% of contribution defined 88.4% of hospital admission structure (Fig.8). Reducing of a fraction in dynamics of hospital admission rate structure is marked in the sailors and foremen who served by contract with I, X and XIX classes of diseases and traumas, stability – with XI and XII classes, increasing – with IX, XIII and XIV classes (Fig.8).

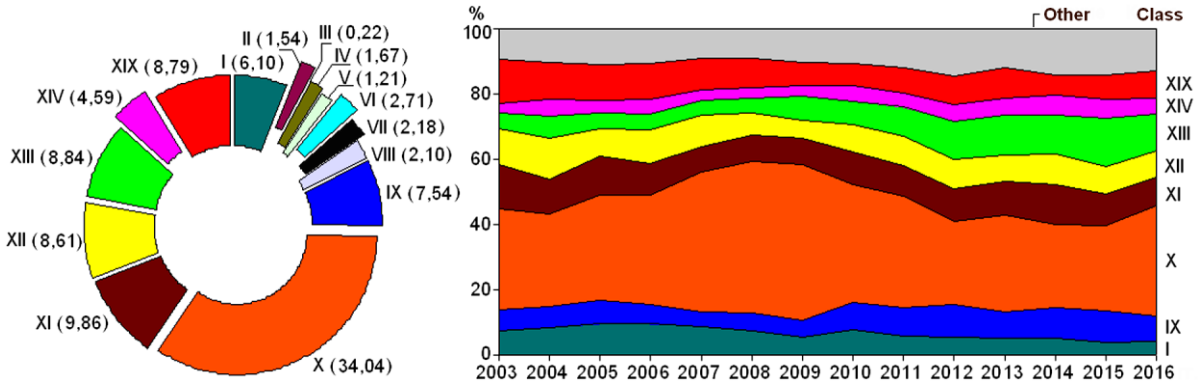

Fig. 8. Structure of hospital admission rate (on the left) and dynamics of the structure (on the right) in the military who served by contract

Days away from work. Average annual rate of days away from work in the sailors and foremen who served on a contract basis was 3866±213‰. Each serviceman who served on a contract basis in the Russian Navy had about 4 days away from work annually. All drafted military in the Russian Armed Forces had almost the same annual rate of days away from work: 3903±118‰. Polynomial trend of days away from work rate with significant determination coefficient ($R^2=0.68$) revealed the reducing trend (Fig.9).

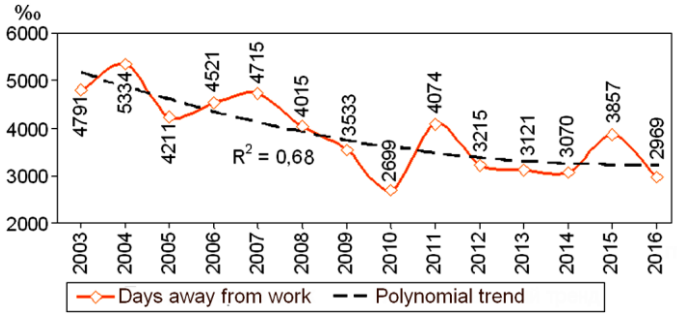

Fig.9. Days away from work rate in the military who served by contract

The highest indicators of days away from work were marked in the sailors and foremen who served by contract with X, XI and XIX classes of diseases and traumas 1246±67, 370±35 and 465±51‰ respectively. All the drafted military in the Russian Armed Forces had almost the same rates of days away from work: 1477±50, 339±16 and 335±30‰ respectively [9, p. 47, 50]. The rate of days away from work in the sailors and foremen was significant less by 10 class of disease and more – by XIX class of traumas ($p<0.05$ for both classes).

Polynomial trends of the main classes with significant determination coefficients revealed reducing trend of days away from work rate in the sailors and foremen who served by contract with X (R^2=0.9), XI (R^2=0.90) and XIX (R^2=0.83) classes of diseases and traumas.

It was found that 7 classes of diseases and traumas (I, IX, X, XI, XII, XIII and XIX) defined 84% of overall structure of days away from work (Fig.10). Reducing of a fraction in dynamics of days away from work structure is marked in the sailors and foremen who served by contract with I, XI and XIX classes of diseases and traumas, stability – with X and XII classes, increasing – with IX and XIII classes (Fig.10).

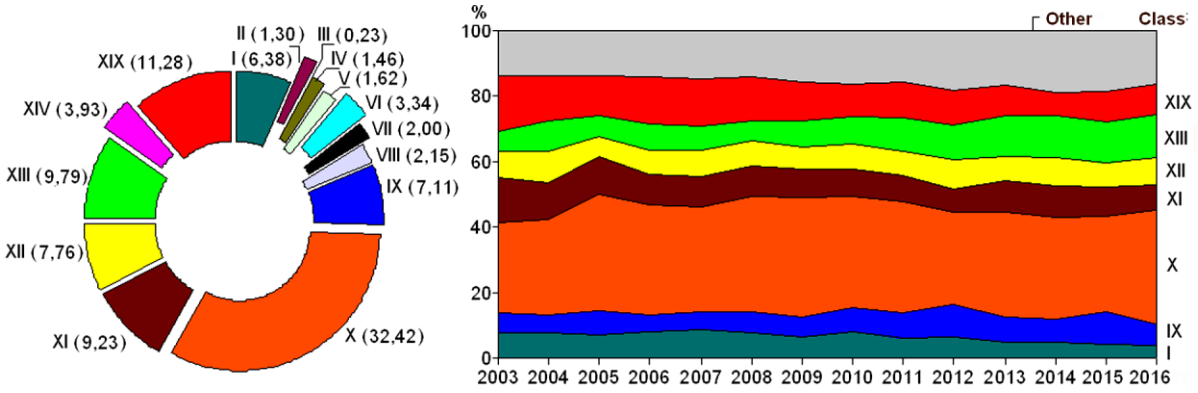

Fig. 10. Structure of days away from work (on the left) and dynamics of the structure (on the right) in the military who served by contract

Dismissal. Average annual rate of dismissal for health reasons in the sailors and foremen who served on a contract basis was 6.29±0.32‰. In all drafted military in the Russian Armed Forces the rate of dismissal was 4.05±0.35‰, statistically significant less ($p<0.001$). Polynomial trend with determination coefficient of high variability ($R^2=0.07$) is similar to flat inverted U-curve and revealed reducing trend in the last observing period (Fig. 11).

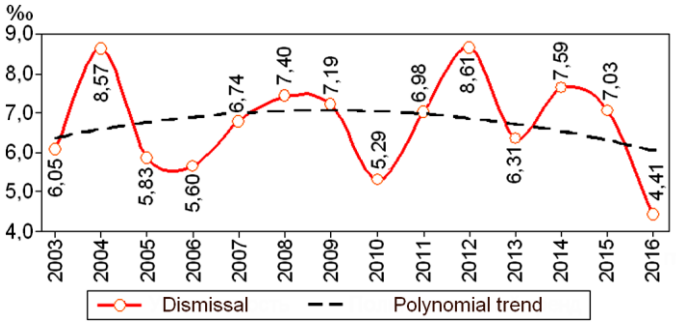

Fig. 11. Dismissal rate in the military who served by contract

The highest indicators of dismissal were marked in the sailors and foremen with IV, V and IX classes of diseases – 0.72±0.09, 0.78±0.09 and 1.31±0.10‰ respectively. In all drafted military the rate of dismissal by the same classes of diseases was 0.22±0.02, 0.87±0.16 and 0.64±0.09‰ respectively [9, p. 57–58]. The rate of dismissal in sailors and foremen was statistically significant more by IV and IX classes of diseases ($p<0.001$ for both classes).

Polynomial trends of indicators of main classes with low determination coefficients show reducing the rate of dismissal in the sailors and foremen with XI ($R^2=0.51$) class of diseases, stability – in servicemen with V ($R^2=0.12$) class and increasing tendency in those with IV ($R^2=0.44$) class of diseases.

It was found that 9 classes of diseases and traumas (I, II, IV, V, IX, XI, XII, XIII and XIX) each of 4,5 share % defined 85.6% of structure of dismissal for health reasons (fig.12). Reducing of a fraction in dynamics of dismissal structure is marked in the sailors and foremen who served by contract with IX, XI, XII classes of diseases, stability – with II class, increasing – with I, IV, V, XIII and XIX classes of diseases (fig.12).

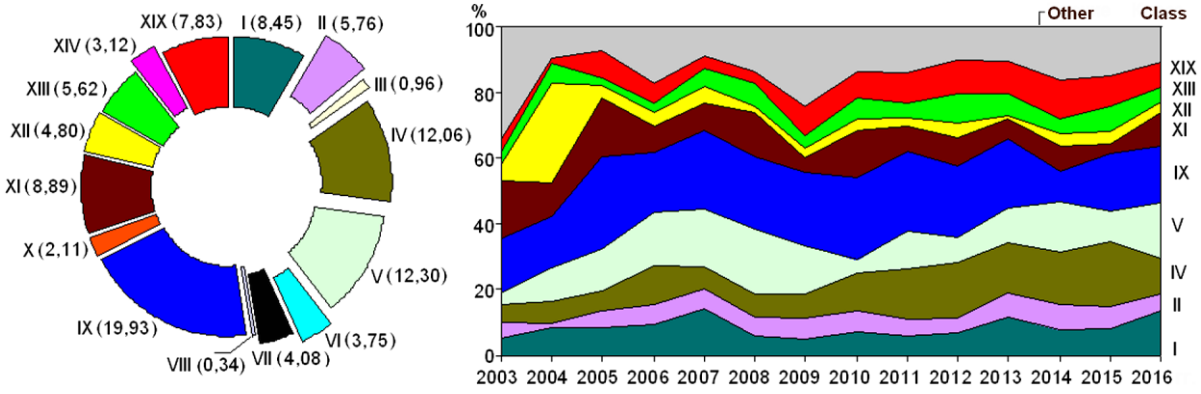

Fig. 12. Structure of dismissal rate for health reasons (on the left) and dynamics of the structure (on the right) in the military who served by contract

Mortality. Average annual mortality rate was 111.8±11.8 deaths in 100 thousands sailors and foremen who served by contract. In all military who served by contract in the Armed Forces of Russia the mortality rate was almost the same, 108.2±6.9. Polynomial trend of the mortality rate with significant determination coefficient (R^2=0,68) reveals reducing trend (Fig.13).

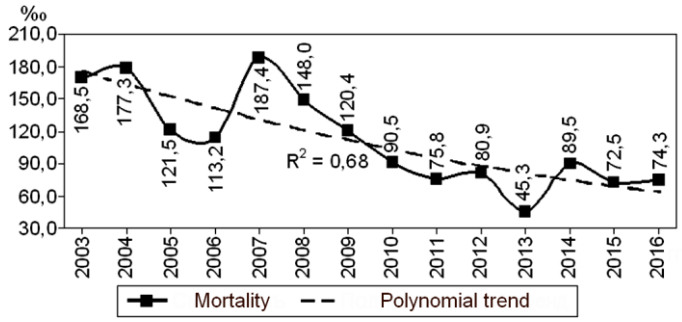

Fig. 13. Mortality rate in the military who served by contract

The highest data of annual mortality rate were marked in 100 thousands sailors and foremen with II, IX and XIX classes of diseases and traumas – 6.9±1.7, 22.4±3.4 and 76.6±9.9 respectively. In all the military who served by contract in the Armed Forces of Russia the mortality rate by the same classes of diseases hasn't reveal statistically significant difference and was 5.5±0.7, 17.4±1.1 and 9.7±6.1 respectively [9, p. 67, 70]. It is worth noting that the rate of death in men of working age in Russia was 1042±47 deaths per 100 thousands men annually in 2003-2015 that was 9.3 times greater than in the sailors and foremen who served on a contract basis ($p<0.001$).

Polynomial trends of main classes with determination coefficients of varying significance revealed reducing trend of mortality rate in sailors and foremen who serve by contract with II (R^2=0.29) and XIX (R^2=0.84) classes of diseases and traumas, stability - in servicemen with IX (R^2=0.11) class of diseases.

It was found that 3 classes of diseases and traumas (II, XI and XIX) defined 94.4% of mortality rate structure (Fig.14). Reducing of a fraction in dynamics of mortality rate structure is marked in the sailors and foremen who served by contract with XIX class of diseases and increasing trend – in servicemen with II and IX classes of diseases (Fig.14).

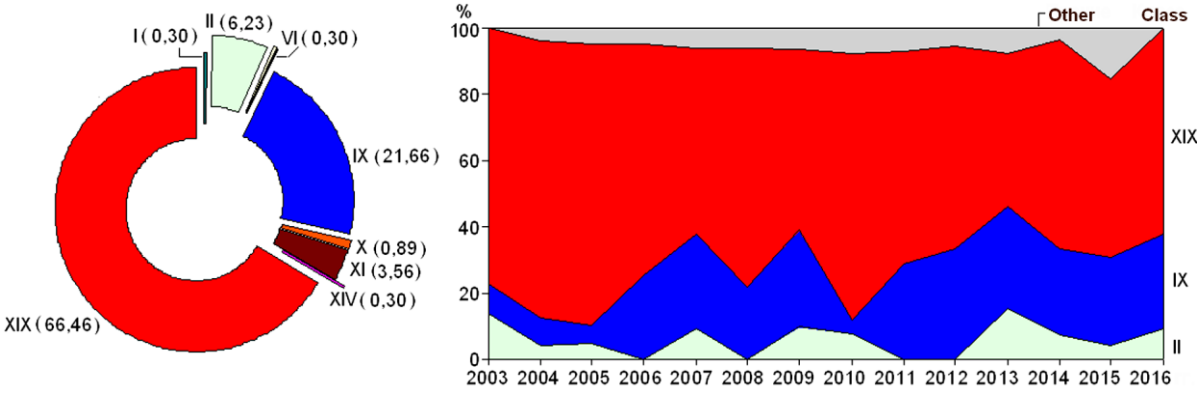

Fig. 14. Structure of mortality rate (on the left) and dynamics of the structure (on the right) in the military who served by contract

Overall assessment of the study. Ranks of classes of diseases in the sailors and foremen who served by contract in a structure of health disorders indicators are given in Table 2. Typically, 1-3 ranks in the structure of health disorders indicators defined the data of X, XI XII and XIII classes of diseases.

Diseases of IX, V and IV classes leaded the ranks in the structure of dismissal for health reasons, diseases of IX and II class and traumas of XIX class – in the structure of mortality rate.

All of the mentioned determined increase in contribution of these classes of diseases and traumas in general assessment of health disorders in the sailors and foremen who served by contract that was formed by us.

Table 2

Ranks of contribution of health disorders in sailors and foremen who served by contract in the Russian Navy by ICD-10 (2003–2016)

Class	Morbidity		Follow-up	Hospitalization	Days out of work	Dismissal	Mortality	Total
	overall	primary						
I	7th	7th	8th	7th	7th	5th	6th- 9th	7th
II	2nd	13th	12th	13 th	14 th	7th	3rd	8th
III	15th	15th	15th	15 th	15 th	14th	6th – 9th	15th
IV	12th	12th	5th	12 th	13 th	3rd		9th
V	14th	14th	13th	14th	12 th	2nd		10th
VI	9th	10th	7th	9th	9 th	11th	6th- 9th	12th
VII	8th	8th	11th	10th	11th	10th		13th
VIII	11th	11th	14th	11th	10th	15th		14th
IX	5th	6th	3rd	6 th	6th	1st	2nd	3rd
X	1st	1st	1st	1st	1 th	13th	5th	2nd
XI	4th	4th-5th	2nd	2nd	4th	4th	4th	4th
XII	3rd	3rd	9 th	5 th	5 th	9th		6th
XIII	2nd	2nd	4 th	3rd	3rd	8th		5th
XIV	10th	9-th	6 th	8 th	8th	12th	6th- 9th	11th
XIX	6th	4/5-th	10 th	4 th	2nd	6th	1st	1st

The calculation carried out has showed that 76.8% of formed overall structure of indicators of health disorders in the sailors and foremen who served by contract was defined by 6 classes (IX, X, XI, XII XIII and XIX) of diseases and traumas (Fig. 15). Almost all the same main classes of overall assessment of health disorders were revealed in all the military who served by contract in the Armed Forces of Russia, but its structure included indicators of V class of diseases as well [9, p. 75].

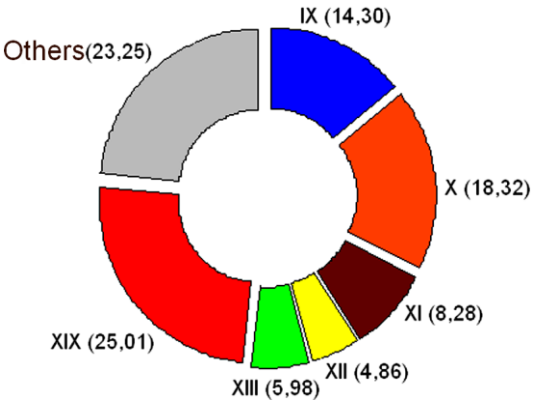

Fig. 15. Overall assessment of health disorders in the military who served by contract

Conclusion. Average annual rate of overall morbidity in the sailors and foremen who served by contract in over a 14-year period (in 2003–2016) was 870.8±73.5‰, primary morbidity – 378.4±20.3‰, need for dynamic follow-up – 88.2±11.4‰, hospitalization –

197.2±10.2‰, days away from work – 3866±213‰, dismissal for health reasons – 6.29±0.32‰, mortality – 111.8±11.8 deaths per 100 thousands of the military in a year. Polynomial trends of the listed indicators with determination coefficients of varying significance revealed reducing trend.

In comparison with all the military who served by contract in the Armed Forces of Russia the sailors and foremen represent statistically significant less rate of primary morbidity, hospitalization and greater rate of dismissal for health reasons.

We formed the structure of overall assessment of health disorders in the sailors and foremen who served by contract. 76.8% of structure included indicators of 6 classes (IX, X, XI, XII XIII and XIX) of diseases and traumas by ICD-10, that are of military-epidemiological significance for the military who served by contract in the Russian Navy. 25% of structure were defined by traumas and other consequences of external causes (XIX class), 18.3% diseases of the respiratory system (X class), 14.3% – diseases of the circulatory system (IX class). Improving preventive measures for diseases and traumas of the indicated classes may promote health status in the Russian Navy military.

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Date of receipt of the article: *February, 18.2018 y.*
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