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LONG-TERM MORBIDITY RATES OF CONTRACT SERVICEMEN OF RUSSIAN NAVY (2003-2021)

[1]Igor G. Mosyagin, [2]Vladimir I. Evdokimov, [3]Mikhail S. Pluzhnik*
[1]Military Medical Department of Main Command of Navy of Russian Federation, St. Petersburg, Russia
[2]Nikiforov Russian Center of Emergency and Radiation Medicine, EMERCOM of Russia, St. Petersburg, Russia
[3]Military Medical Academy, St. Petersburg, Russia

OBJECTIVE. To study the medical and statistical indicators of military personnel's morbidity undergoing military service under contract, which will enable to clarify the necessary forces and means of the medical service, and focus on prevention of leading classes of diseases and injuries.
MATERIALS AND METHODS. We studied the morbidity rates of contract servicemen in the reports on the health status of personnel and the activities of the medical service in the form 3/MED of military units in which at least 70 % of the total number of Russian Navy servicemen served. Nosology was aligned with the chapters of the International Classification of Diseases and Related Health Disorders, 10th revision (ICD-10). The morbidity rate was calculated per 1000 servicemen or in ppm (‰), mortality – per 100 thousand people or 10^{-5}. We calculated the morbidity and its share in the categories of servicemen serving under contract: officers and warrant officers, sailors and petty officers, female servicemen.
RESULTS. The average long-term level of primary morbidity of contract servicemen in the Russian Navy for 19 years (2003–2021) was 389.4 ‰ with a share of 44.2 % of the structure of the entire cohort morbidity in the Russian Navy, hospitalizations – 228.7 ‰ and 32.1 %, days of work loss – 4734.7 ‰ and 41.2 %, dismissals – 11.81 ‰ and 42.1 %, mortality – 93.74 $\times 10^{-5}$ and 87.6 %, respectively. The dynamics show a level decrease in almost all accounting types of morbidity in the last observation period, with the exception of a slight increase in the level of primary morbidity. In the Russian Navy contract servicemen, in comparison with the Russian Navy cohort, there is an increase in the proportion of cases for all types of morbidity, with the exception of dismissal, which has decreased in the last observation period. The most pronounced levels of morbidity (except for mortality) were recorded in female servicemen with a low proportion in the structure. There are large unrealized opportunities in the implementation of medical and preventive measures for female servicemen. In the dynamics of the structure for all types of morbidity, an increase in the proportion was revealed among sailors and petty officers, with a decrease in the proportion of other categories of contract servicemen.
CONCLUSION. Focusing on prevention, early detection of diseases in the leading classes, their treatment and rehabilitation can significantly reduce morbidity and improve the health of military personnel. The presented medical and statistical indicators will allow calculating the forces and resources for planning the organization of medical support for military personnel serving under contract in the Russian Navy.

KEYWORDS: marine medicine, contract servicemen, officers, warrant officers, sailors, petty officers, female servicemen, morbidity, hospitalization, work losses, dismissal, mortality, Russian Navy.

***For correspondence:** *Vladimir I. Evdokimov, e-mail: 9334616@mail.ru*
***Для корреспонденции:** *Евдокимов Владимир Иванович, e-mail: 9334616@mail.ru*

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МНОГОЛЕТНИЕ ПОКАЗАТЕЛИ ЗАБОЛЕВАЕМОСТИ ВОЕННОСЛУЖАЩИХ ПО КОНТРАКТУ ВМФ РОССИИ (2003–2021 ГГ.)

[1]И. Г. Мосягин, [2]В. И. Евдокимов, [3]М. С. Плужник*

[1] Военно-медицинское управление Главного командования Военно-Морского Флота Российской Федерации, Санкт-Петербург, Россия

[2]Всероссийский центр экстренной и радиационной медицины имени А. М. Никифорова МЧС России, Санкт-Петербург, Россия

[3]Военно-медицинская академия имени С. М. Кирова, Санкт-Петербург, Россия

ЦЕЛЬ. Изучить медико-статистические показатели заболеваемости военнослужащих, проходящих военную службу по контракту, что позволит уточнить необходимые силы и средства медицинской службы, акцентировать внимание на профилактике по ведущим классам болезней и травм.

МАТЕРИАЛЫ И МЕТОДЫ. Изучили показатели заболеваемости военнослужащих по контракту в отчетах о состоянии здоровья личного состава и деятельности медицинской службы по форме 3/МЕД воинских частей, в которых проходили службу не менее 70 % от общего числа военнослужащих ВМФ России. Нозологии согласовали с классами Международной классификации болезней и расстройств, связанных со здоровьем, 10-го пересмотра (МКБ-10). Уровень заболеваемости рассчитали на 1000 военнослужащих или в промилле (‰), смертность – на 100 тыс. человек или 10^{-5}. Вычислили заболеваемость и ее долю у категорий военнослужащих, проходящих военную службу по контракту: офицеров и мичманов, матросов и старшин, военнослужащих женского пола.

РЕЗУЛЬТАТЫ. Среднемноголетний уровень первичной заболеваемости военнослужащих по контракту в ВМФ России за 19 лет (2003–2021 гг.), составил 389,4 ‰ с долей 44,2 % от структуры от всей заболеваемости когорты в ВМФ России, госпитализации – 228,7 ‰ и 32,1 %, дней трудопотерь – 4734,7 ‰ и 41,2 %, увольняемости – 11,81 ‰ и 42,1 %, смертности – 93,74 × 10^{-5} и 87,6 % соответственно. Отмечается динамика снижения уровней практически во всех учетных видах заболеваемости в последний период наблюдения, за исключением незначительного увеличения уровня первичной заболеваемости. У военнослужащих по контракту ВМФ России в сравнении с когортой ВМФ России отмечается увеличение долей случаев по всем учетным видам заболеваемости, за исключением увольняемости, при которой отмечается уменьшение в последний период наблюдения. Наиболее выраженные уровни заболеваемости (за исключением смертности) регистрировались у военнослужащих женского пола с низкой долей в структуре. При проведении лечебно-профилактических мероприятий военнослужащим женского пола имеются большие нереализованные возможности. В динамике структуры по всем учетным видам заболеваемости выявлено увеличение долей у матросов и старшин, при уменьшении долей остальных категорий военнослужащих по контракту.

ЗАКЛЮЧЕНИЕ. Акцентирование внимания на профилактике, раннем выявлении болезней по ведущим классам, их лечение и реабилитация могут существенно уменьшить заболеваемость и повысить состояние здоровья военнослужащих. Представленные медико-статистические показатели позволят рассчитать силы и средства для планирования организации медицинского обеспечения военнослужащих, проходящих военную службу по контракту в ВМФ России.

КЛЮЧЕВЫЕ СЛОВА: морская медицина, военнослужащие по контракту, офицеры, мичманы, матросы, старшины, военнослужащие-женщины, заболеваемость, госпитализация, трудопотери, увольняемость, смертность, ВМФ России

Introduction. The state of health is an important indicator of combat readiness and combat capability of troops [1]. Health indicators are of high importance for military personnel of the Russian Navy, who often perform combat missions on long-range campaigns, where it is sometimes impossible to provide specialized medical care [2, 3]. The previous editions present the morbidity rates of all Russian Navy personnel [4] and conscripted military personnel [5].

The objective is to study medical and statistical indicators of morbidity among military personnel serving under contract, including officers and warrant officers, sailors and petty officers, female military personnel from 2003 to 2021 (peacetime), which will make it possible to clarify the necessary forces and means of the medical service, and focus on prevention for leading classes of diseases and injuries.

Material and methods. We studied the morbidity rates of contract servicemen presented in the database of medical reports on the health status of personnel and the activities of the medical service in form 3/MED of military units in which at least 70 % of the total number of Russian Navy servicemen served from 2003 to 2021. We also studied the morbidity rates of military personnel published in open statistical collections prepared by employees of the Main Military Medical Directorate of the Russian Ministry of Defense [6].

The analysis of the results was carried out according to the types of morbidity specified in the

regulatory document on military medical reporting in peacetime[1]: primary, with hospitalization (hospitalization), with temporary loss of ability to work (work losses), dismissal due to health reasons and mortality.

The nosology was aligned with the chapters of the International Classification of Diseases and Related Health Disorders, 10th revision (ICD-10). The incidence rate was calculated per 1.000 military personnel or in per mille (‰), and the mortality rate per 100.000 people or 10^{-5}. The incidence rate and its share were calculated for categories of military personnel serving under contract: officers and warrant officers, sailors and petty officers, and female military personnel.

The data arrays were formed and the statistical processing of the obtained information was carried out using the methods presented in Microsoft Excel 2007 and Statistica 10.0 by StatSoft. The results were checked for normality of the distribution of features using the Kolmogorov–Smirnov criterion. The text indicates the average long-term level, calculated based on the sum of absolute indicators for 19 years, and the average annual level – based on annual incidence rates in the form of arithmetic means and errors of average values (M ± SE).

In some publications, when analyzing the morbidity of military personnel, a military-epidemiological assessment of the significance of disease chapter indicators was calculated [7, 8], and for the civilian population, a coefficient of relative importance for generalized morbidity [9] or a complex index for health problems [10].

In our study, the assessment was adjusted: the chapter contribution to the mortality structure was multiplied by a factor of 3, dismissal by a factor of 2, primary morbidity by 1.5, and the remaining data had a factor of 1 [5]. The sum of proportions of morbidity types by disease chapters, regarding the assigned coefficients, constituted a complex indicator. Based on the complex indicator, the percentage of the contribution of each chapter to the structure of the assessment of the military-epidemiological significance of health disorders in servicemen of the Russian Navy was determined.

[1]Guidelines for medical record keeping and reporting in the Armed Forces of the Russian Federation during peacetime. Moscow: N. N. Burdenko Main Military Clinical Hospital, 2001, 40 p. (In Russ.)

The dynamics of health indicators in the Russian Navy servicemen were studied using the analysis of dynamic series and the calculation of the second-order polynomial trend [11]. The determination coefficient (R^2) showed the association of the studied data with the constructed curve (trend). The higher the determination coefficient (maximum 1.0) was, the more objectively the trend was constructed. The indicator 0.5 was adopted as the threshold for the determination coefficient, with lower values indicating a trend of changes. The icon in the tables shows the trend of data growth, ↓ – decrease, → – stability, ∪ – U -curve, ∩ – inverted U-curve, etc.

Results. ***Primary morbidity.*** The average long-term level of primary morbidity among contract servicemen of the Russian Navy for 19 years from 2003 to 2021 was 389.4 ‰, the average annual level was (386.7 ± 10.5) ‰ (Table 2), the cohort of the Russian Navy was 571.9 ‰ and (577.2 ± 12.3) ‰, respectively. The share of morbidity among contract servicemen was 44.2 %, conscript servicemen – 55.8 % ($p < 0.001$) of all cases of primary morbidity in the Russian Navy.

The 1st rank of significance of primary morbidity was made up of indicators of diseases of the respiratory system (Chapter X), the 2nd rank – of the musculoskeletal system and connective tissue (Chapter XIII), the 3rd rank – of the circulatory system (Chapter IX), the 4th rank – of the digestive system (Chapter XI), the 5th rank – of the skin and subcutaneous tissue (Chapter XII) (see Table 1). The total proportion of these diseases was 74.6 % of the structure of all primary morbidity in the Russian Navy.

With different significance of the coefficients of determination, the polynomial trend of the primary morbidity rate of contract servicepersons shows an increase in data, the Russian Navy cohort – resembles the trend of the inverted U-curve (Fig. 1,A). The congruence of trends is positive, low and statistically insignificant ($r = 0.160$; $p > 0.05$), which may indicate the influence of different (oppositely directed) factors in their development. The polynomial trend of the proportion of cases of primary morbidity among contract servicemen from the structure of the Russian Navy cohort (see Fig. 1, B) shows an increase in data.

Among the contract servicemen of the Russian Navy, cases of primary morbidity were registered among officers and warrant officers in 48.9 %,

Table 1

Indicators of primary morbidity of contract servicemen of the Russian Navy

Таблица 1

Показатели первичной заболеваемости военнослужащих по контракту ВМФ России

ICD-10 chapter	Average long-term level, ‰	Structure		R^2	Dynamics	Average annual level, (M ± SE) ‰
		%	*rank			
I	13.8	3.5	8	0.49	∪↑	13.2 ± 2.3
II	5.4	1.4	13	0.58	∩↑	5.6 ± 0.3
III	0.6	0.2	15	0.22	∩	0.7 ± 0.1
IV	7.2	1.9	12	0.73	∩↑	7.6 ± 0.7
V	2.9	0.8	14	0.49	∩↓	3.0 ± 0.2
VI	12.5	3.2	9	0.05	↓	12.4 ± 0.5
VII	10.9	2.8	10	0.22	∩↓	11.0 ± 0.6
VIII	9.5	2.4	11	0.16	↓	9.5 ± 0.3
IX	26.8	6.9	**3**	0.52	∩↑	27.2 ± 1.0
X	166.6	42.6	**1**	0.54	∪↑	163.7 ± 7.9
XI	26.6	6.8	**4**	0.12	↑	26.7 ± 0.6
XII	25.2	6.5	**5**	0.04	↑	25.3 ± 0.8
XIII	45.9	11.8	**2**	0.86	↑	45.2 ± 3.7
XIV	15.9	4.1	7	0.29	∩↓	16.1 ± 0.5
XIX	19.7	5.1	6	0.90	↓	19.6 ± 1.7
Total	389.4	100.0		0.56	∪↑	386.7 ± 10.5

*Here and in Tables 3, 5, 7, 9, 11: 1–5 ranks of innovation are highlighted in bold

*Здесь и в табл. 3, 5, 7, 9, 11: полужирным шрифтом выделены 1–5-й ранги значимости

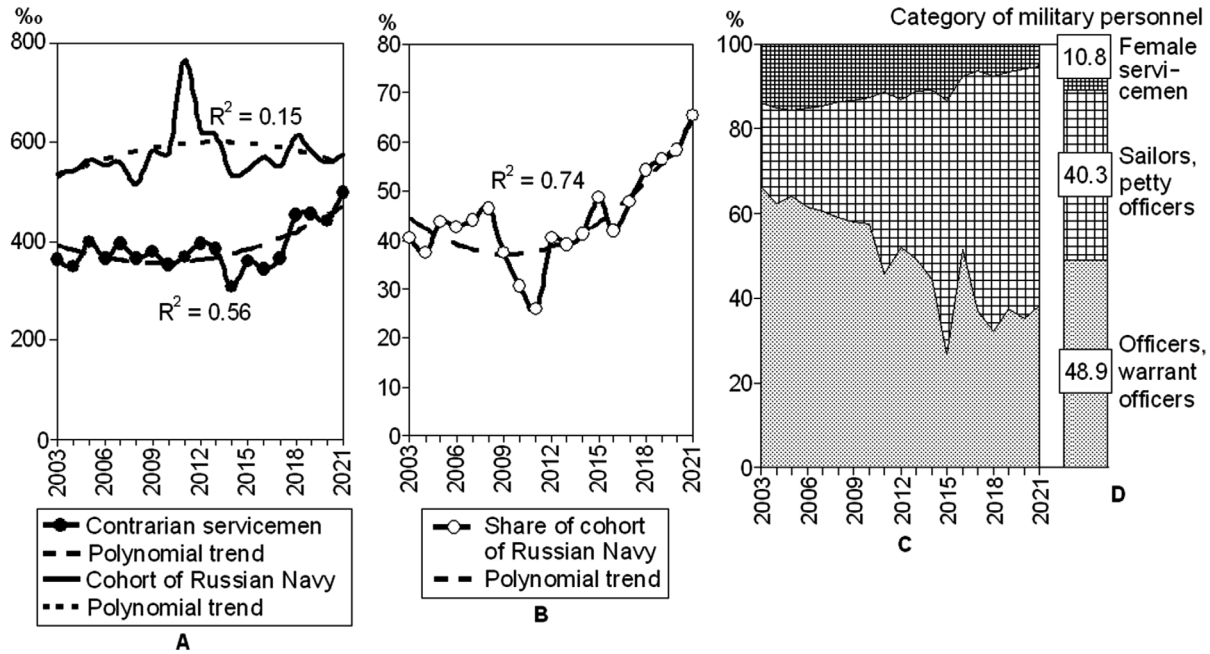

Fig . 1. Dynamics of the primary incidence rate (A), proportion of the Russian Navy cohort (B), dynamics of the structure (C), structure (D) among categories of contract servicemen

Рис. 1. Динамика уровня первичной заболеваемости (A), доля от когорты ВМФ России (B), динамика структуры (C), структура (D) у категорий военнослужащих по контракту

Table 2

Primary morbidity rates for categories of contract servicemen of the Russian Navy

Таблица 2

Показатели первичной заболеваемости категорий военнослужащих по контракту ВМФ России

Category of military personnel	Average long-term level, ‰	Proportion of contract servicemen, %	R^2	Dynamics	Average annual level, (M ± SE) ‰
1. Officers, warrant officers	358.0	48.9	0.24	↑	361.3 ± 11.1
2. Sailors, petty officers	403.5	40.3	0.78	∪	400.5 ± 18.4
3. Female servicemen	531.1	10.8	0.19	∩↑	553.8 ± 23.0
					p
					1–3 < 0.001
					2–3 < 0.001

among sailors and petty officers serving under contract – in 40.3 %, among female servicemen – in 10.8 % (see Fig. 1,D). The dynamics show a decrease in the proportion of cases of primary morbidity among officers and female servicemen, and an increase in the proportion of sailors and petty officers (see Fig. 1,C).

The generalized indicators of primary morbidity of categories of contract servicemen of the Russian Navy are presented in Table 3, the visual arrangement of average values is in Fig. 2. As a rule, the levels of primary morbidity of categories of servicemen demonstrated the tendency of data increase. The most pronounced indicators of primary morbidity were among female servicemen. Their average long-term level when compared with officers and sailors, petty officers of contract service was higher by 1.5 and 1.3 times, respectively ($p < 0.001$ for both categories) (see Table 2, Fig. 2).

Hospitalization. The average long-term hospitalization level of contract servicemen in the Russian Navy was 228.7 ‰, the average annual level was (229.1 ± 7.9) ‰ (Table 4), for the cohort of servicemen of the Russian Navy it was 462.3 ‰ and (470.9 ± 17.2) ‰, respectively. The share of contract servicemen was 32.1 %, conscript servicemen – 67.9 % ($p < 0.001$) of all hospitalization cases in the Russian Navy.

The 1st rank of hospitalization significance was made up of respiratory diseases (Chapter X), the 2nd rank – circulatory system diseases (Chapter IX), the 3rd rank – musculoskeletal system and connective tissue diseases (Chapter XIII), the 4th rank – digestive organs (Chapter XI), the 5th rank – genitourinary system diseases (Chapter XIV) (see Table 3). The total share of these diseases was 67.8 % of the total hospitalization structure in the Russian Navy.

With different significance of the coefficients of determination, the polynomial trend of the hospitalization rate of contract servicemen resembles the trend of low variability of indicators of the Russian Navy cohort – an inverted U-curve (Fig. 3,A). The congruence of trends is positive, low and statistically insignificant ($r = 0.173$; $p > 0.05$), which may indicate the influence of different (oppositely directed) factors in their development. The polynomial trend of the proportion of hospitalization cases among contract servicemen from the structure of all servicemen of the Russian Navy shows an increase in data (see Fig. 3, B).

Among the contract servicemen of the Russian Navy, cases of hospitalization were registered among officers and warrant officers in 52.5 %, among sailors and petty officers serving under contract – in 36.5 %, among female servicemen – in 11 % (see Fig. 3, D). The dynamics show a decrease in the proportion of hospitalization cases among officers and female servicemen, and an increase in the proportion of sailors and petty officers (see Fig. 3,C).

The generalized hospitalization rates for categories of contract servicemen of the Russian Navy are presented in Table 5, the average values are clearly shown in Fig. 4. The hospitalization rate for officers and warrant officers showed a

Table 3

Hospitalization rates of contract servicemen of the Russian Navy

Таблица 3

Показатели госпитализации военнослужащих по контракту ВМФ России

ICD-10 chapter	Average long-term level, ‰	Structure		R^2	Dynamics	Average annual level, (M ± SE) ‰
		%	rank			
I	10.3	4.5	8	0.24	∪↑	10.1 ± 1.0
II	5.9	2.6	11	0.61	∩↑	6.0 ± 0.5
III	0.7	0.3	15	0.23	∩↑	0.7 ± 0.1
IV	9.4	4.1	9	0.54	∩	9.7 ± 0.7
V	2.9	1.3	14	0.64	↓	2.9 ± 0.2
VI	7.4	3.3	10	0.13	∩	7.5 ± 0.3
VII	5.3	2.3	12	0.37	∩↓	5.3 ± 0.4
VIII	4.1	1.8	13	0.12	↑	4.1 ± 0.2
IX	31.7	13.9	**2**	0.61	∩↓	32.2 ± 1.4
X	54.2	23.4	**1**	0.08	↑	53.2 ± 4.8
XI	25.8	11.3	**4**	0.58	↓	25.8 ± 1.2
XII	13.4	5.9	7	0.25	↑	13.4 ± 0.8
XIII	29.2	12.8	**3**	0.65	↑	29.3 ± 2.1
XIV	14.6	6.4	**5**	0.38	∩↓	14.7 ± 0.6
XIX	14.0	6.1	6	0.70	↓	14.0 ± 0.7
Total	228.7	100.0		0.09	→	229.1 ± 7.9

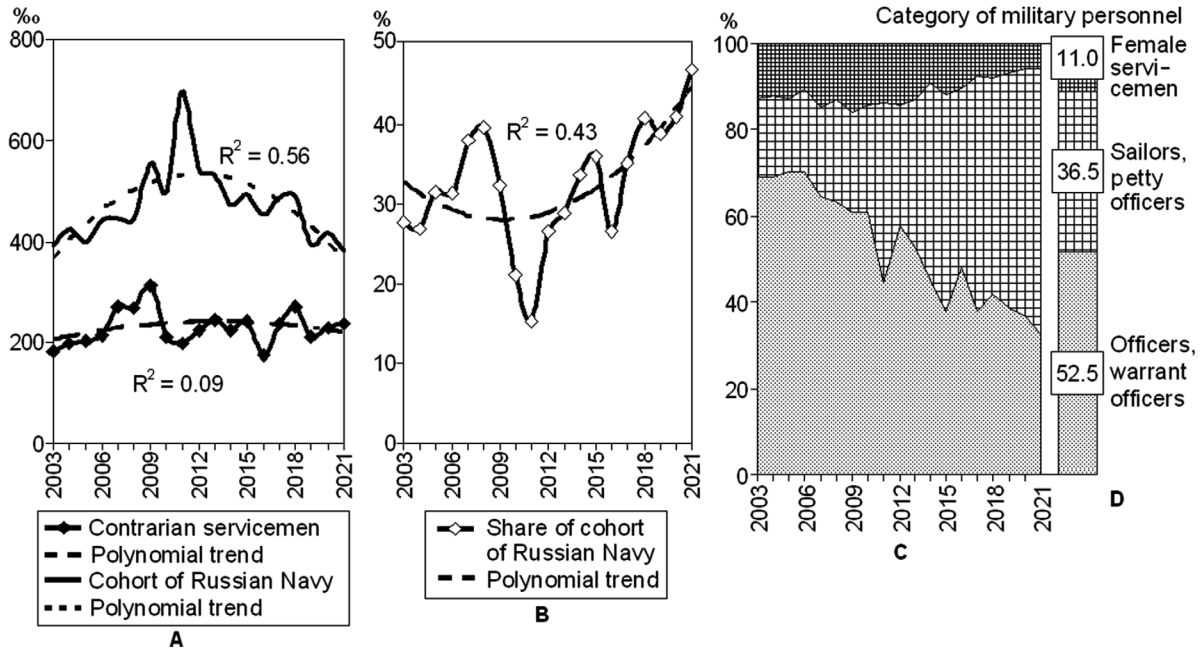

Fig. 3. Dynamics of the hospitalization rate (A), proportion of the Russian Navy cohort (B), dynamics of the structure (C), structure (D) among categories of contract servicemen

Рис. 3. Динамика уровня госпитализации (A), доля от когорты ВМФ России (B), динамика структуры (C), структура (D) у категорий военнослужащих по контракту

downward trend in the last observation period, while for other categories it showed an increase in the data. The most pronounced hospitalization rates were for female servicemen. The average

Table 4

Hospitalization rates for categories of contract servicemen of the Russian Navy

Таблица 4

Показатели госпитализации у категорий военнослужащих по контракту ВМФ России

Category of military personnel	Average long-term level, ‰	Proportion of contract servicemen, %	R^2	Dynamics	Average annual level, (M ± SE) ‰
1. Officers, warrant officers	225.9	52.5	0.28	∩	229.6 ± 9.9
2. Sailors, petty officers	214.4	36.5	0.32	∪↑	211.2 ± 8.9
3. Female servicemen	316.9	11.0	0.42	∩	342.5 ± 27.4
					p
					1–3 < 0.001
					2–3 < 0.001

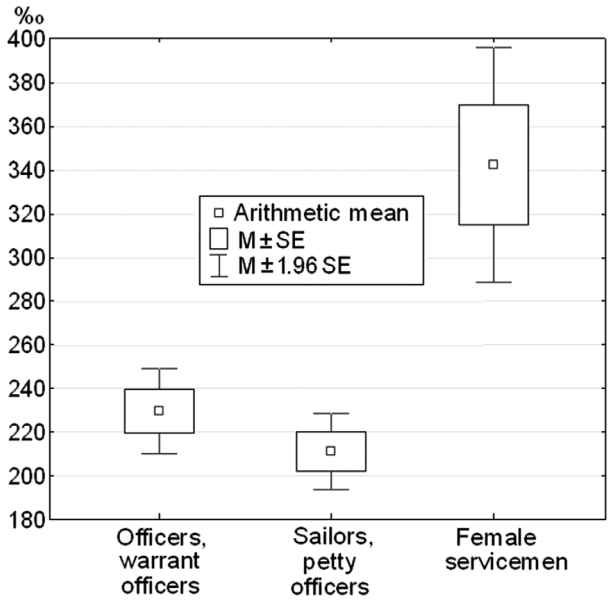

Fig. 4. Average annual level of hospitalization of categories of contract servicemen of the Russian Navy

Рис. 4. Среднегодовой уровень госпитализации категорий военнослужащих по контракту ВМФ России

long-term rate, when compared with officers and sailors, and petty officers of contract service, was 1.6 ($p < 0.001$) and 1.2 ($p < 0.005$) times higher, respectively (see Table 4, Fig. 4).

Days of lost work. The average long-term level of days of work losses among Russian Navy servicemen serving under contract was 4734.7 ‰, the average annual level was (4737.5 ± 141.0) ‰ (Table 6), in the Russian Navy cohort – 7311.4 ‰ and (7416.1 ± 247.2) ‰, respectively. The share of days of work losses among contract servicemen was 42.1 %, among conscripts – 57.9 % ($p < 0.001$) of all cases of work losses.

The 1st rank of significance of days of work losses was made up of indicators of diseases of the respiratory system (Chapter X), 2nd–3rd rank – of the circulatory system (Chapter IX) and the musculoskeletal system and connective tissue (Chapter XIII), 4th rank – of the digestive system (Chapter XI), 5th rank – of injuries, poisoning and some other consequences of exposure to external causes (Chapter XIX) (see Table 5). The total share of these diseases was 69.9 % of the structure of all days of work losses in the Russian Navy.

At low coefficients of determination, the polynomial trend of the level of days of work losses of contract servicemen shows a tendency of decreasing indicators, the cohort of the Russian Navy – an inverted U-curve (Fig. 5,A). The congruence of trends is positive, low and statistically insignificant ($r = 0.292$; $p > 0.05$), which may indicate the influence of different (oppositely directed) factors in their development. The polynomial trend of the proportion of cases of contract servicemen's work losses from the structure of all servicemen of the Russian Navy resembles a U-curve with an increase in data (see Fig. 5, B).

Among the contract servicemen of the Russian Navy, cases of days of work loss were registered among officers and warrant officers in 55 %, among sailors and petty officers serving under contract – in 32.9 %, among female servicemen – in 12.1 % (see Fig. 5, D). The dynamics show a decrease in the proportion of cases of days of work loss among officers and female servicemen, an increase in the proportion of sailors and petty officers (see Fig. 5, C).

Table 5

Indicators of days of work loss for contract servicemen of the Russian Navy

Таблица 5

Показатели дней трудопотерь у военнослужащих по контракту ВМФ России

ICD-10 chapter	Average long-term level, ‰	Structure		R^2	Dynamics	Average annual level, (M ± SE) ‰
		%	rank			
I	232.1	4.9	8	0.30	∪↑	227.0 ± 30.7
II	98.7	2.1	11	0.49	∩↑	101.3 ± 6.0
III	15.7	0.3	15	0.29	∩	16.2 ± 1.3
IV	162.1	3.4	10	0.41	∩↓	165.2 ± 11.5
V	71.1	1.5	14	0.32	↓	71.2 ± 3.4
VI	169.9	3.6	9	0.55	↓	171.6 ± 8.0
VII	91.8	1.9	12	0.46	∩↓	93.7 ± 5.4
VIII	86.7	1.8	13	0.05	∩	87.2 ± 3.5
IX	627.5	13.3	**2–3**	0.68	↓	637.2 ± 35.0
X	1187.4	25.2	**1**	0.38	∪↑	1170.4 ± 53.9
XI	483.8	10.2	**4**	0.77	↓	482.5 ± 33.7
XII	256.3	5.4	6	0.10	↑	256.1 ± 15.6
XIII	627.7	13.3	**2–3**	0.41	↑	630.9 ± 33.6
XIV	247.6	5.2	7	0.70	↓	250.6 ± 12.5
XIX	376.3	7.9	**5**	0.72	↓	376.7 ± 25.4
Total	4734.7	100.0		0.15	–	4737.5 ± 141.0

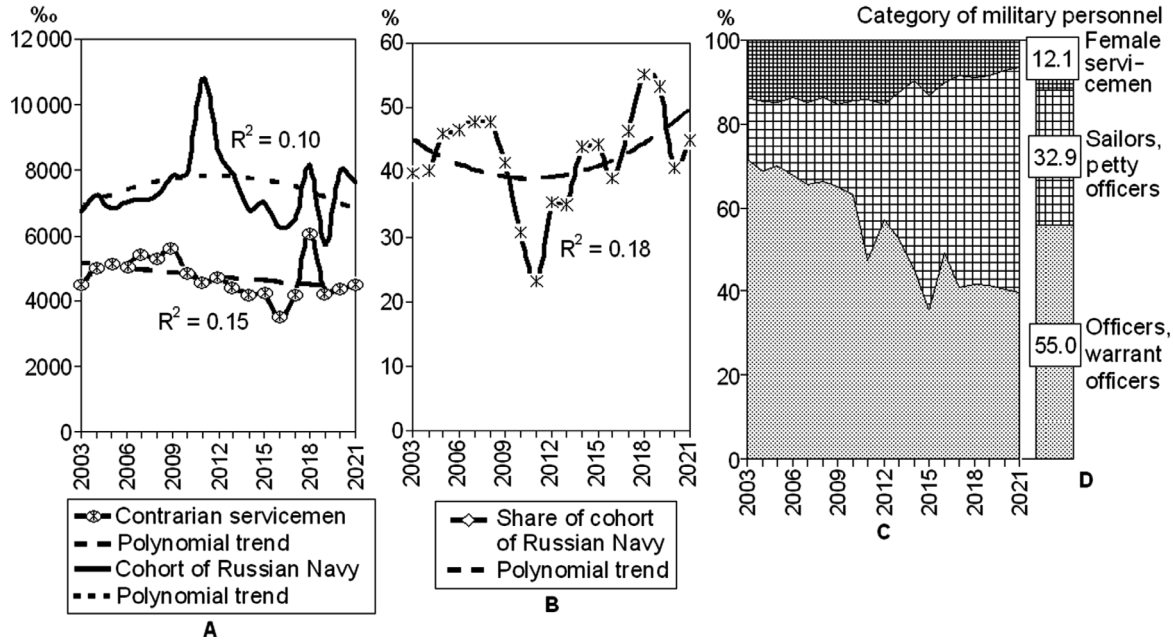

Fig. 5. Dynamics of the level of days of work losses (A), proportion of the Russian Navy cohort (B), dynamics of the structure (C), structure (D) of categories of contract servicemen

Рис. 5. Динамика уровня дней трудопотерь (A), доля от когорты ВМФ России (B), динамика структуры (C), структура (D) категорий военнослужащих по контракту

The summarized indicators of days of work loss for categories of contract servicemen of the Russian Navy are presented in Table 7, the visual arrangement of average values is in

Table 6

Indicators of days of work loss for categories of contract servicemen of the Russian Navy

Таблица 6

Показатели дней трудопотерь у категорий военнослужащих по контракту ВМФ России

Category of military personnel	Average long-term level, ‰	Proportion of contract servicemen, %	R^2	Dynamics	Average annual level, (M ± SE) ‰
1. Officers, warrant officers	4895.8	55.0	0.12	↓	4878.1 ± 168.4
2. Sailors, petty officers	4007.7	32.9	0.41	∪↑	4057.7 ± 171.3
3. Female servicemen	7227.0	12.1	0.26	∩	7590.7 ± 429.1

p
1–3 < 0.001
2–3 < 0.001

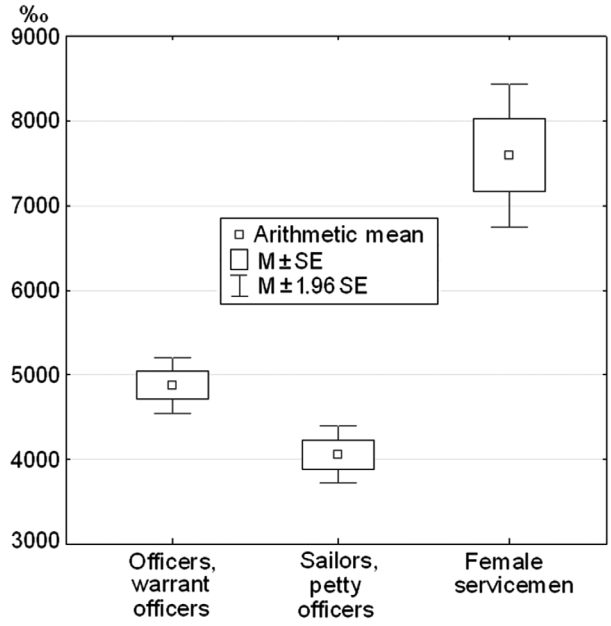

Fig. 6. Average annual level of workdays lost among categories of contract servicemen of the Russian Navy

Рис. 6. Среднегодовой уровень дней трудопотерь у категорий военнослужащих по контракту ВМФ России

Fig. 6. The most pronounced indicators of days of work loss were among female servicemen. The average long-term level when compared to officers and sailors, petty officers of contract service was 1.5 ($p < 0.001$) and 1.8 ($p < 0.001$) times higher, respectively. The level of days of work loss among officers was 1.2 times higher than among sailors, petty officers of contract service (see Table 6, Fig. 6).

Dismissal rate. The average long-term level of dismissal due to health reasons among Russian Navy servicemen serving under contract was 11.81 ‰, the average annual level was (12.17 ± 1.04) ‰ (Table 8), in the Russian Navy cohort it was 18.24 ‰ and (18.34 ± 1.21) ‰, respectively. The share of dismissals among contract servicemen was 42.1 %, and among conscripts it was 57.9 % ($p < 0.001$) of all cases in the Russian Navy cohort.

The 1st rank of significance of dismissals consisted of indicators of diseases of the circulatory system (Chapter IX), the 2nd rank – of the endocrine system, nutritional disorders and metabolic disorders (Chapter IV), the 3rd rank – of the musculoskeletal system and connective tissue (Chapter XIII), the 4th rank – of the digestive organs (Chapter XI), the 5th rank – of mental disorders and behavioral disorders (Chapter V) (see Table 7). The total proportion of these diseases amounted to 68.5 % of the structure of all dismissals in the Russian Navy.

With high coefficients of determination, the polynomial trends of the level of dismissal of contract servicemen and the entire cohort of the Russian Navy show a decrease in data (Fig. 7,A). The congruence of trends is positive, strong and statistically significant ($r = 0.816$; $p < 0.001$), which may indicate the influence of the same (unidirectional) factors in their development, for example, military-professional ones. The polynomial trend of the proportion of cases of dismissal among contract servicemen from the structure of all servicemen of the Russian Navy resembles a U-curve with an increase in data (see Fig. 7, B).

Among the contract servicemen of the Russian Navy, cases of dismissal were registered among

Table 7

Rates of dismissals due to health reasons of contract servicemen of the Russian Navy

Таблица 7

Показатели увольнения по состоянию здоровья военнослужащих по контракту ВМФ России

ICD-10 chapter	Average long-term level, ‰	Structure		R^2	Dynamics	Average annual level, (M ± SE) ‰
		%	rank			
I	0.35	3.0	11	0.12	∩	0.36 ± 0.03
II	0.75	6.3	6	0.56	∩↓	0.77 ± 0.06
III	0.08	0.7	15	0.01	→	0.08 ± 0.02
IV	1.94	16.5	**2**	0.69	∩↓	2.04 ± 0.20
V	0.82	6.9	**5**	0.25	↓	0.82 ± 0.04
VI	0.45	3.8	8–9	0.78	↓	0.45 ± 0.05
VII	0.32	2.7	12	0.56	∩↓	0.33 ± 0.04
VIII	0.12	1.0	14	0.48	↓	0.12 ± 0.02
IX	3.46	29.2	**1**	0.69	↓	3.59 ± 0.45
X	0.26	2.2	13	0.05	↓	0.27 ± 0.05
XI	0.93	7.9	**4**	0.81	↓	0.93 ± 0.12
XII	0.41	3.5	10	0.63	∩↓	0.43 ± 0.04
XIII	0.94	8.0	**3**	0.58	∩↓	0.98 ± 0.08
XIV	0.45	3.8	8–9	0.74	↓	0.45 ± 0.07
XIX	0.53	4.5	7	0.44	∩↓	0.56 ± 0.06
Total	11.81	100.0		0.75	↓	12.17 ± 1.04

officers and warrant officers in 65.5 %, among sailors and petty officers serving under contract – in 22 %, among female servicemen – in 12.5 % (see Fig. 7, D). The dynamics show a decrease in the proportion of dismissal cases among officers and female servicemen, and an increase in the proportion of sailors and petty officers (see Fig. 7, C).

The general indicators of dismissal of categories of military personnel under contract of the Russian Navy are presented in Table 9, the visual arrangement of average values is in Fig. 8. The most pronounced indicators of dismissals were among female military personnel. The average long-term level when compared with officers and sailors, petty officers of contract service was higher by 1.3 ($p > 0.05$) and 2.8 ($p < 0.001$) times, respectively. The level of dismissals of officers was higher than that of sailors, petty officers of contract service by 2.1 times ($p < 0.001$) (see Table 8, Fig. 8).

Mortality. The average long-term mortality rate of contract servicemen of the Russian Navy was 93.7×10^{-5}, the average annual – $(94.1 \pm 4.8) \times 10^{-5}$ (Table 10), the entire cohort – 69.6×10^{-5} and $(68.6 \pm 3.8) \times 10^{-5}$, respectively. The rate of mortality of contract servicemen was 87.6 %, conscript servicemen – 12.4 % ($p < 0.001$) of all deaths in the cohort of the Russian Navy.

In the analyzed period, there were no cases of deaths of contract servicemen due to diseases VII, VII, XII chapters are not taken into account. The 1st rank of mortality significance was made up of indicators of injuries, poisoning and some other consequences of external causes (Chapter XIX), the 2nd rank – diseases of the circulatory system (Chapter IX), the 3rd rank – neoplasms (Chapter II), the 4th rank – diseases of the digestive organs (Chapter XI), the 5th rank – some infectious and parasitic diseases (Chapter I) (see Table 9). The total proportion of these diseases was 97.2 % of the structure of all mortality in the Russian Navy.

With high determination coefficients, the polynomial trends of the mortality rate of contract servicemen and the entire cohort of the Russian Navy show a decrease in data (Fig. 9,A). The congruence of trends is positive, very strong and statistically significant ($r = 0.916$; $p < 0.001$), which may indicate the influence of the same (unidirectional) factors in their development, such

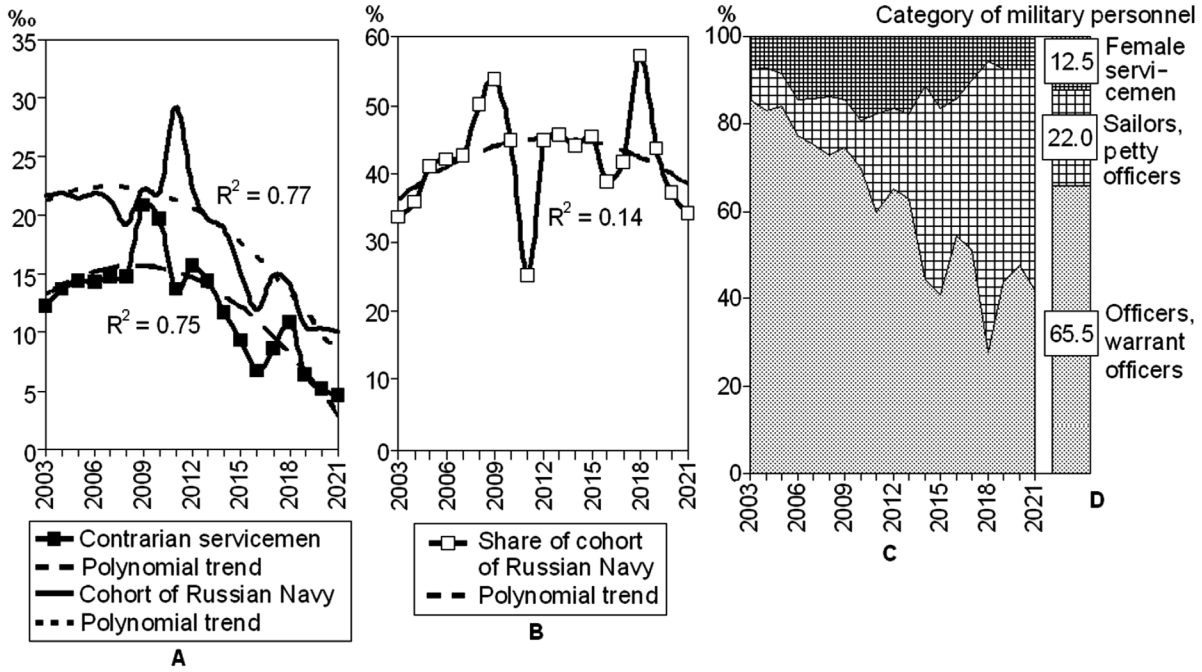

Fig. 7. Dynamics of the level of dismissal (A), proportion of the Russian Navy cohort (B), dynamics of the structure (C), structure (D) of categories of contract servicemen

Рис. 7. Динамика уровня увольняемости (A), доля от когорты ВМФ России (B), динамика структуры (C), структура (D) категорий военнослужащих по контракту

Table 8

Dismissal rates for health reasons for categories of contract servicemen Russian Navy

Таблица 8

Показатели увольняемости по состоянию здоровья категорий военнослужащих по контракту ВМФ России

Category of military personnel	Average long-term level, ‰	Proportion of contract servicemen, %	R^2	Dynamics	Average annual level, (M ± SE) ‰
1. Officers, warrant officers	14.56	65.5	0.70	∩↓	14.27 ± 1.44
2. Sailors, petty officers	6.67	22.0	0.05	∩	6.78 ± 0.53
3. Female servicemen	18.67	12.5	0.62	∩↓	20.72 ± 3.06
					p
					1−3 < 0.001
					2−3 < 0.001

as military-professional ones. The polynomial trend of the proportion of mortality cases among contract servicemen from the structure of all servicemen of the Russian Navy resembles a U-curve with an increase in data (see Fig. 9, B).

Among the contract servicemen of the Russian Navy, mortality cases were registered among officers and warrant officers in 56.8 %, among sailors and petty officers serving under contract – in 38.5 %, among female servicemen – in 4.7 % (see Fig. 9,D). The dynamics show a decrease in the proportion of mortality cases among officers and female servicemen, and an increase in the proportion of sailors and petty officers (see Fig. 9,C).

The general mortality rates of the categories of contract servicemen of the Russian Navy are presented in Table 11, the location of the average values is clearly shown in Fig. 10. The least

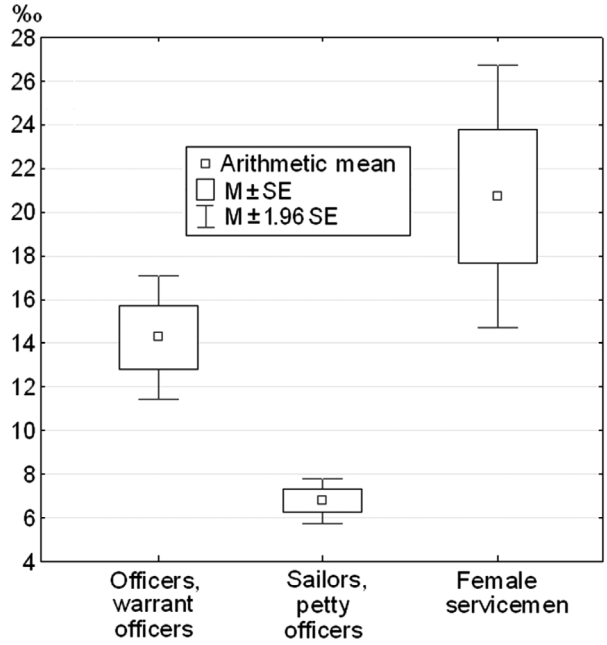

Fig. 8. Average annual level of dismissal of categories of contract servicemen of the Russian Navy
Рис. 8. Среднегодовой уровень увольняемости категорий военнослужащих по контракту ВМФ России

pronounced mortality rates were among female servicemen. The average long-term level when compared with officers and sailors, petty officers of contract service was 1.8 and 1.7 times lower, respectively ($p < 0.001$ for both categories) (see Table 10, Fig. 10).

Military-epidemiological significance. The results of the assessment of military-epidemiological significance by chapters of diseases among contract servicemen of the Russian Navy in 2003–2021 are summarized in Table 11. The sum of the proportion of morbidity types, considering the assigned coefficients, constituted a complex indicator.

The 1st–5th rank of the military-epidemiological assessment of morbidity among contract servicemen of the Russian Navy included indicators (listed in order of severity) of diseases of the circulatory system (Chapter IX) with a share of 19.8 %, injuries, poisoning and some other consequences of exposure to external causes (Chapter XIX) – 18.2 %, diseases of the respiratory system (Chapter X) – 16 %, digestive system (Chapter XI) – 8.8 %, musculoskeletal system and connective tissue (Chapter XIII) – 8.1 % (see Table 12).

The total contribution of the listed diseases and injuries amounted to 70.9 % of the military epidemiological assessment structure. Early detection, prevention, treatment and rehabilitation of the listed diseases and injuries can significantly reduce the incidence of contract servicemen of the Russian Navy.

Table 9

Mortality rates of contract servicemen of the Russian Navy

Таблица 9

Показатели смертности военнослужащих по контракту ВМФ России

ICD-10 chapter	Average long-term level, 10^{-5}	Structure		R^2	Dynamics	Average annual level, (M ± SE) × 10^{-5}
		%	rank			
I	1.0	1.1	**5**	0.20	↑	1.0 ± 0.4
II	11.0	11.8	**3**	0.09	∩↓	11.2 ± 0.8
III	0.1	0.1	11–12	0.05	↓	0.1 ± 0.1
IV	0.6	0.6	7–8	0.12	∩↓	0.7 ± 0.2
V	0.2	0.2	10	0.03	∩	0.2 ± 0.2
VI	0.6	0.6	7–8	0.01	↓	0.6 ± 0.2
IX	25.5	27.2	**2**	0.16	∩↓	26.0 ± 1.8
X	0.8	0.9	6	0.01	↓	0.8 ± 0.2
XI	5.1	5.5	**4**	0.16	∩↑	5.3 ± 0.7
XII	0.1	0.1	11–12	0.35	↑	0.1 ± 0.1
XIV	0.3	0.3	9	0.32	↓	0.3 ± 0.1
XIX	48.5	51.6	**1**	0.81	↓	47.9 ± 3.6
Total	93.7	100.0		0.56	↓	94.1 ± 4.8

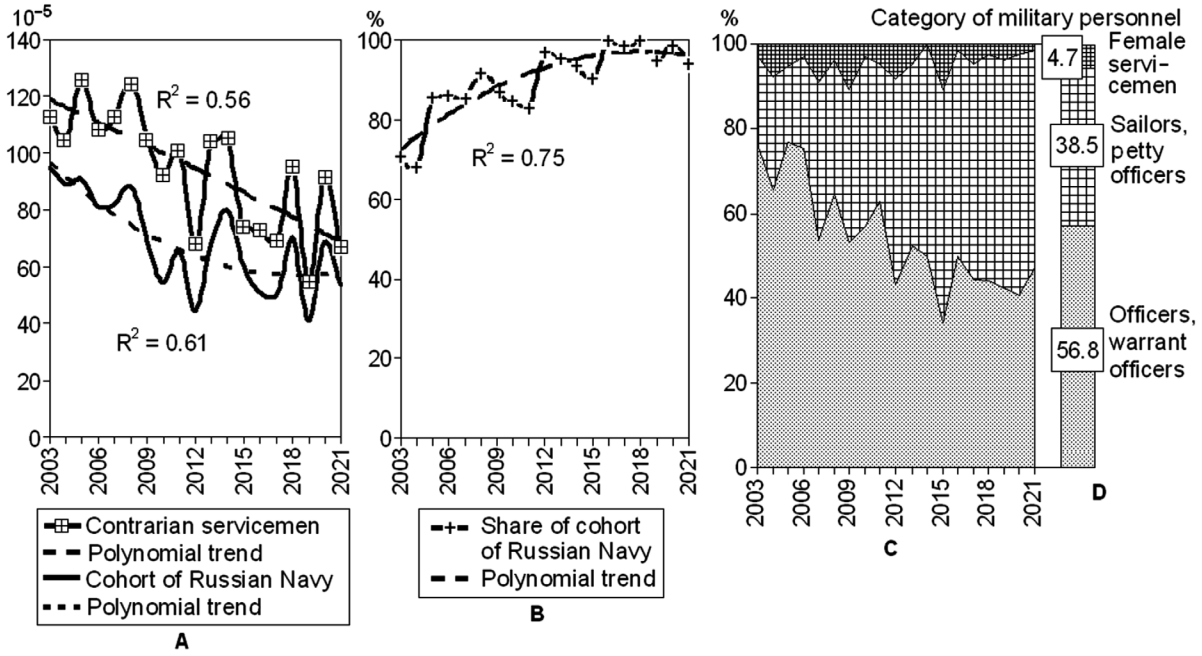

Fig. 9. Dynamics of mortality rate (A), share of Russian Navy cohort (B), dynamics of structure (C), structure (D) of categories of contract servicemen

Рис. 9. Динамика уровня смертности (A), доля от когорты ВМФ России (B), динамика структуры (C), структура (D) категорий военнослужащих по контракту

Table 10

Mortality rates of categories of contract servicemen of the Russian Navy

Таблица 10

Показатели смертности категорий военнослужащих по контракту ВМФ России

Category of military personnel	Average long-term level, 10^{-5}	Proportion of contract servicemen, %	R^2	Dynamics	Average annual level, (M ± SE) × 10^{-5}
1. Officers, warrant officers	100.1	56.8	0.29	↓	97.8 ± 5.6
2. Sailors, petty officers	92.8	38.5	0.67	↓	105.6 ± 9.2
3. Female servicemen	55.5	4.7	0.17	∩↓	55.5 ± 7.5
					p
					1–3 < 0.001
					2–3 < 0.001

Discussion. The average annual incidence rate of contract servicemen of the Russian Navy for 19 years (2003–2021) was 929.8 ‰ with a share of 50.9 % of the total incidence of the Russian Navy cohort, primary morbidity – 389.4 ‰ and 44.2 %, the need for dispensary supervision – 133.7 ‰ and 63.2 %, hospitalization – 228.7 ‰ and 32.1 %, days labor loss – 4734.7 ‰ and 41.2 %, layoffs – 11.81 ‰ and 42.1 %, mortality – 93.74 × 10^{-5} and 87.6 %, respectively.

There is a decrease in levels in almost all registered types of morbidity in the last period of follow-up, with the exception of a slight increase in the level of primary morbidity. Military personnel under the contract of the Russian Navy, in comparison with the cohort of the Russian Navy, have an increase in the proportion of cases for all registered types of morbidity, with the exception of dismissals, in which there was a decrease in the last period of observation.

The most pronounced morbidity rates (with the exception of mortality) were recorded in female military personnel with a low proportion in the structure. When carrying out med-

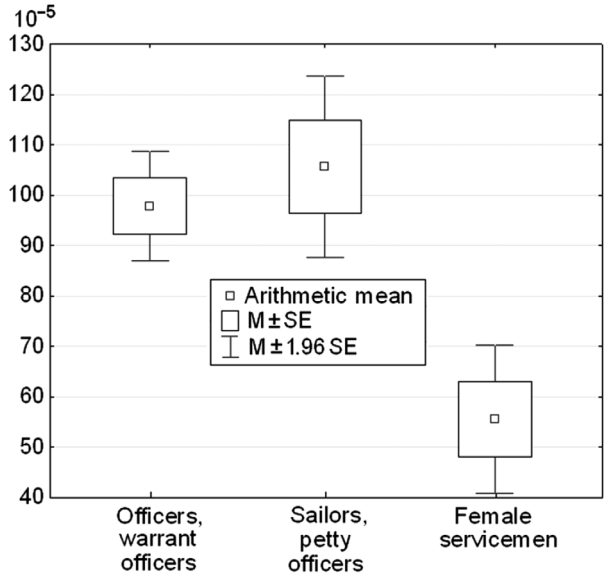

Fig. 10. Average annual mortality rate of categories of contract servicemen of the Russian Navy
Рис. 10. Среднегодовой уровень смертности категорий военнослужащих по контракту ВМФ России

Table 11

Indicators of military-epidemiological significance of morbidity among contract servicemen

Таблица 11

Показатели военно-эпидемиологической значимости заболеваемости военнослужащих по контракту

ICD-10 chapter	Complex indicator	Structure, %	Rank
I	29.8	2.8	10–11
II	58.9	5.6	6
III	3.2	0.3	15
IV	57.4	5.5	7
V	20.6	2.0	12
VI	29.0	2.8	10–11
VII	18.5	1.8	13
VIII	12.6	1.2	14
IX	208.8	19.8	**1**
X	167.9	16.0	**3**
XI	92.2	8.8	**4**
XII	37.1	3.5	9
XIII	85.2	8.1	**5**
XIV	37.7	3.6	8
XIX	191.4	18.2	**2**
Total	1050.0		

ical and preventive measures for female military personnel, there are great unrealized opportunities.

Conclusion. Focusing on prevention, early detection of diseases in leading chapters, their treatment and rehabilitation can significantly reduce morbidity and improve the health status of military personnel. The presented medical and statistical indicators will allow us to calculate the forces and means for planning the organization of medical care for military personnel serving under contract in the Russian Navy.

Information about the authors:

Igor G. Mosyagin – Dr. of Sci. (Med.), Professor, Head of the Military Medical Department of the Main Command of the Navy of the Russian Federation; 191055, Saint Petersburg, Admiralteiskiy Proezd, 1; ORCID: 0000-0002-9485-6584; e-mail: mosyagin-igor@mail.ru

Vladimir I. Evdokimov – Dr. of Sci. (Med.), Professor, Principal Research Associate, Nikiforov Russian Center of Emergency and Radiation Medicine, EMERCOM of Russia; 194044, Saint Petersburg, Academician Lebedev Str., 4/2; ORCID: 0000-0002-0771-2102; e-mail: 9334616@mail.ru

Mikhail S. Pluzhnik – Sixth Year Cadet at the Faculty of Training of Doctors for the Navy, Military Medical Academy; 194044, Saint Petersburg, Academician Lebedev Str., 6; ORCID: 0009-0002-0535-533X; e-mail: pluzhnikms@yandex.ru

Сведения об авторах:

Мосягин Игорь Геннадьевич – доктор медицинских наук, профессор, начальник военно-медицинского управления, Главное командование Военно-Морского Флота Российской Федерации; 191055, Санкт-Петербург, Адмиралтейский пр-д, д. 1; ORCID: 0000-0002-9485-6584; e-mail: mosyagin-igor@mail.ru

Евдокимов Владимир Иванович – доктор медицинских наук, профессор, главный научный сотрудник, Всероссийский центр экстренной и радиационной медицины им. А. М. Никифорова МЧС России; 194044, Санкт-Петербург, ул. Академика Лебедева, д. 4/2; ORCID: 0000-0002-0771-2102; e-mail: 9334616@mail.ru

Плужник Михаил Сергеевич – курсант VI курса факультета подготовки врачей для Военно-Морского Флота Российской Федерации, Военно-медицинская академия им. С. М. Кирова; 190044, Санкт-Петербург, ул. Академика Лебедева, д. 6; ORCID: 0009-0002-0535-533X; e-mail: pluzhnikms@yandex.ru

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Special contribution: IGM aided in the research concept. VIE analysis of data, prepared illustrations. MSP provided collection of primary data. VIE, MSP – prepared the manuscript. IGM – final approved.

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