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Research Article



Indicators of health groups of pupils of general education organizations of the Russian Ministry of Defense (2010–2022)

Ivan K. Soldatov¹, Vladimir I. Evdokimov^{1, 2}, Vadim G. Arsentiev¹,
Ruslan G. Makiev¹, Veronika Yu. Golovinova³

¹ Military Medical Academy, Saint Petersburg, Russia;

² Nikiforov Russian Center of Emergency and Radiation Medicine, EMERCOM of Russia, Saint Petersburg, Russia;

³ Rostov State Medical University, Military Training Center, Rostov-on-Don, Russia

ABSTRACT

BACKGROUND: Currently, there are 33 educational organizations of the Russian Ministry of Defense in Russia with a total staff of about 18 thousand students studying around the clock

AIM: to assess the dynamics of the health status of students in educational institutions of the Russian Ministry of Defense for 12 years from 2010/2011 to 2021/2022 academic year.

MATERIALS AND METHODS: We studied reports on Form 13K/МЕД, prepared by employees of educational organizations of the Russian Ministry of Defense, and calculated the dynamics of the level of assessments of the health status of students. The article presents arithmetic averages and their errors; the development of health groups was assessed using time series analysis, for which a second-order polynomial series was used.

RESULTS: In general educational institutions, there were $25.3 \pm 0.9\%$ of pupils with health group I, $60.7 \pm 0.6\%$ with group II, and $14.0 \pm 1.2\%$ with group III. In recent years, there has been a tendency to increase the number of pupils with health groups I and II and decrease with group III. These results indicated a properly organized educational process and optimization of medical support for students. The most positive dynamics of health status were observed in pupils aged 10–12 years, less pronounced — in pupils aged 16–18 years.

CONCLUSIONS: In some educational organizations of the Russian Ministry of Defense during the period studied, there were not entirely favorable trends in the organization of medical support for students, which aims at more personalized work with students.

Keywords: cadet; children; health group; medical examination; pupil; Russian Ministry of Defense; teenager.

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Научная статья

Показатели групп здоровья воспитанников общеобразовательных организаций Минобороны России (2010–2022 гг.)

И.К. Солдатов¹, В.И. Евдокимов^{1, 2}, В.Г. Арсентьев¹, Р.Г. Макиев¹, В.Ю. Головинова³¹ Военно-медицинская академия, Санкт-Петербург, Россия;² Всероссийский центр экстренной и радиационной медицины им. А.М. Никифорова МЧС России, Санкт-Петербург, Россия;³ Ростовский государственный медицинский университет, военный учебный центр, Ростов-на-Дону, Россия

АННОТАЦИЯ

Актуальность. В настоящее время в России функционируют 33 общеобразовательные организации Минобороны России с общей штатной численностью около 18 тыс. воспитанников, обучающихся с круглосуточным пребыванием.

Цель — оценить динамику состояния здоровья воспитанников общеобразовательных организаций Минобороны России за 12 лет — с 2010/2011 по 2021/2022 учебный год.

Материал и методы. Изучили отчеты по форме 13К/МЕД, подготовленные сотрудниками общеобразовательных организаций Минобороны России, рассчитали динамику уровня оценок состояния здоровья воспитанников. В статье представлены средние арифметические величины и их ошибки, развитие групп здоровья оценили при помощи анализа динамических рядов, для чего использовали полиномиальный ряд второго порядка.

Результаты. В общеобразовательных организациях воспитанников с I группой здоровья было $25,3 \pm 0,9$ %, со II — $60,7 \pm 0,6$ %, с III группой — $14,0 \pm 1,2$ %. В последние годы отмечается тенденция увеличения числа воспитанников с I и II группами здоровья и уменьшения — с III группой. Эти результаты свидетельствовали о правильно организованном учебно-воспитательном процессе и оптимизации медицинского сопровождения учащихся. Наиболее положительная динамика состояния здоровья отмечалась у воспитанников в возрасте 10–12 лет, менее выраженная — у воспитанников в возрасте 16–18 лет.

Заключение. В некоторых общеобразовательных организациях Минобороны России изученного периода отмечались не вполне благоприятные тенденции организации медицинского сопровождения воспитанников, что нацеливает на более персонифицированную работу с обучаемыми.

Ключевые слова: группа здоровья; дети; диспансеризация; кадет; Минобороны России; подросток; суворовец.

Как цитировать

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研究文章

俄罗斯国防部普通教育机构学生健康群体指标 (2010–2022年)

Ivan K. Soldatov¹, Vladimir I. Evdokimov^{1, 2}, Vadim G. Arsentiev¹,
Ruslan G. Makiev¹, Veronika Yu. Golovinova³¹ Military Medical Academy, Saint Petersburg, Russia;² Nikiforov Russian Center of Emergency and Radiation Medicine, EMERCOM of Russia, Saint Petersburg, Russia;³ Rostov State Medical University, Military Training Center, Rostov-on-Don, Russia

简评

现实意义。目前，俄罗斯国防部共有33个普通教育机构，总计约18 000名学生全天候在校学习。

本研究旨在评估俄罗斯国防部普通教育机构学生从2010/2011学年到2021/2022学年12年间的健康状况动态。

材料和方法。我们研究了由俄罗斯国防部普通教育机构员工编制的表格13/KMED报告，并计算了学生健康状况评估水平的动态变化。本文介绍了算术平均值及其误差；通过分析动态数列评估了健康组的发展状况，为此使用了二阶多项式数列。

结果。在普通教育机构中， $25.3 \pm 0.9\%$ 的学生属于健康状况I组， $60.7 \pm 0.6\%$ 属于健康状况II组， $14.0 \pm 1.2\%$ 属于健康状况III组。近年来，健康状况I组和健康状况II组的学生人数呈上升趋势，健康状况III组的学生人数呈下降趋势。这些结果证明，教育过程组织得当，对学生的医疗支持也得到了优化。10–12岁学生的健康状况最为积极，16–18岁学生的健康状况则不太乐观。

结论。在研究期间，注意到俄罗斯联邦国防部的一些普通教育机构在组织学生医疗支持方面出现了不太有利的趋势，这表明需要与学生进行更加个性化的工作。

关键词：健康组；儿童；体检；学员；俄罗斯国防部；青少年；苏沃罗韦茨军校。

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BACKGROUND

The following health groups of pupils are distinguished in general educational organizations of the Russian Ministry of Defense based on normative documents: group I, healthy pupils with normal development and level of basic functions; group II, those having functional or morphological abnormalities after acute diseases and are frequently ill (hypertrophy of palatine tonsils of 1–2 degree, nasal septum curvature without disruption of external respiratory function, posture disorders, flattened foot, myopia, low degree hypermetropia, moderate vegetative lability of pubertal genesis, functional systolic murmur, etc.); and group III, patients with chronic diseases in a state of compensation, with preserved functional capabilities of the organism. This includes anemia, obesity, malnutrition, vegetovascular dystonia, hypotonia, delayed physical and/or sexual development, flat feet, scoliosis, and varicose veins in the spermatic cord¹.

The search conducted in the Russian Science Citation Index² revealed 152 responses to Russian scientific articles on medical and biological aspects of the life activity of pupils, including students of Suvorov schools and cadets, published from 2005 to 2022. The publications were divided into two categories: those reflecting the state of health, including functional reserves of the organism, and those reflecting morbidity, physical development, physical fitness, quality of life, and socio-psychological features of the pupils' personality.

The health determinants for pupils in Suvorov schools, cadet classes, and corps of the Russia Ministry of Education and Ministry of Defense and other ministries and departments where over 200,000 people study include genetic predisposition, individual personality characteristics, and round-the-clock stay on the educational organization's premises, which shape lifestyle, nutrition, social relationships, and physical and psychophysiological development. Excessive daily and weekly educational and intellectual loads, reduced break duration between lessons and optional classes, and anthropogenic contaminants (e.g., aromatic hydrocarbons and aldehydes, chlorine-containing substances, etc.) were the main determinants of the negative impact of the educational process. Furthermore, nutritional factors, including micronutrient deficiency (i.e., vitamins C, B₂, and A, calcium,

phosphorus, and magnesium) and excess of macronutrients (fats and carbohydrates), were found to contribute to this impact. Although anthropogenic contaminant content was within permissible levels, when combined with other factors, they posed a risk to the health of students [1].

In some studies, the health assessment results of students from Suvorov schools and cadet corps were compared to those of students of the same age in general educational schools in the region. For instance, the staff of Astrakhan State Medical University conducted a series of articles on the health status, physical development, nonspecific resistance, and functional state of cadets at admission and after 5 years of training in the I.A. Biryukov Cossack Cadet Corps (Astrakhan Oblast) [2–5].

Moreover, Balashova et al. presented the state of health of pupils at the Samara Cadet Corps. Ashvitz described the Omsk Cadet Corps, whereas Balashova et al. studied the Tver Suvorov Military School. Additionally, Zhilina et al. studied an unspecified cadet corps [6–9].

Pointing out the differences in absolute indices between the health groups of pupils in Suvorov schools and cadet corps is crucial. These studies have shown that the appropriate organization of the educational process, a beneficial daily routine, rational nutrition, and education have a positive effect on the health of cadets compared to students in general educational schools.

Studies that assess the health status of pupils over a long period of time were not found.

This study *aimed* to evaluate the health status dynamics of pupils attending general educational organizations under the Russian Ministry of Defense for a 12-year period, from the academic year 2010/2011 to 2021/2022.

MATERIALS AND METHODS

There are currently 33 general educational organizations under the Russian Ministry of Defense, with a total staff of approximately 18,000 students attending full-time.

We analyzed Form 13K/MED reports created by the Ministry of Defense's general educational organization staff from the 2010/2011 to 2021/2022 academic years.

The percentages of health assessments for general educational organizations were calculated and categorized by age group: 10–12 years (31.1%), 13–15 years (43.9%), and 16–18 years (25%), and the distribution was 31.1%, 46.9%, and 25%, respectively.

Data were assessed for normal distribution. The article presents the arithmetic mean values and their errors ($M \pm m$). The development of indicators was analyzed by examining dynamic series and calculating the second-order polynomial trend [10]. The coefficient of

¹ On Approval of the Standard Regulations on Medical Provision of Students of Presidential Cadet, Suvorov Military, Nakhimov Naval, and Moscow Military Musical Schools, as well as Cadet (Sea Cadet) Corps of the Ministry of Defense of the Russian Federation: Order of the Ministry of Defense of the Russian Federation dated September 09. 10.2012 No. 3100; On the Procedure for Medical Examinations of Minors, including upon Entry to Educational Institutions and During Training: Instructions of the Head of the Main Military Medical Department of the Russian Ministry of Defense, dated April 15, 2013, no. 161/2/2/721.

² <https://elibrary.ru/>

determination (R^2) indicates the objectivity of the polynomial curve. The higher the R^2 value (maximum: 1.0), the closer the curve approximates the actual data distribution.

RESULTS

Table 1 presents the average annual shares of health groups of pupils of general educational organizations of the Russian Ministry of Defense from 2010/2011 to 2021/2022 academic years.

The distribution of children in the general population was as follows: group I, $25.3\% \pm 0.9\%$; group II, $60.7\% \pm 0.6\%$; and group III, $14.0\% \pm 1.2\%$. The polynomial trends observed in the dynamics of students in groups I and II (Fig. 1, A and 1, B) resembled *U*-curves, with an increasing trend in the last period of study.

In contrast, the trend observed in group III (Fig. 1, C) resembled an inverted *U*-curve, with maximum values observed between 2012/2013 and 2017/2018, followed by a decrease in the last years of observation.

In 2010/2011, 31.8% of pupils were in health group I. This figure decreased to 26.7% in 2021/2022, indicating a 4.9% decrease. Importantly, this is a general indicator, and further analysis of indicators in each general educational organization of the Russian Ministry of Defense is critical to fully understand the trends in medical support for students over the years.

However, the educational process has a clearly positive impact on pupils in health groups II and III. In comparison to 2010/2011, the percentage of pupils with group II has slightly increased by 1.3%, whereas the percentage of pupils with group III has decreased by 3.8%.

Table 1. Average annual shares of health groups of pupils of general education organizations of the Russian Ministry of Defense, %
Таблица 1. Среднегодовые доли групп здоровья воспитанников общеобразовательных организаций Минобороны России, %

Health group	Age. years	Academic year												$M \pm m$
		2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	
I	General	31.8	28.4	23.4	23.8	25.1	23.4	21.7	21.2	26.6	25.7	26.3	26.7	25.3 ± 0.9
	10–12	24.6	27.1	26.0	28.8	30.4	29.4	29.7	25.6	33.2	29.3	33.5	32.5	29.2 ± 0.9
	13–15	29.7	24.9	19.4	20.6	21.8	20.0	18.4	20.5	23.6	23.0	22.4	23.0	22.3 ± 0.9
	16–18	39.4	39.1	26.5	23.3	24.2	22.2	18.4	15.7	23.5	25.6	24.6	25.9	25.7 ± 2.0
II	General	62.0	63.0	57.9	59.4	56.8	60.0	61.1	61.4	57.9	61.8	63.1	63.3	60.7 ± 0.6
	10–12	72.6	65.1	61.4	60.8	57.6	57.8	60.7	61.0	56.9	64.2	61.5	63.5	61.9 ± 1.2
	13–15	65.7	66.4	56.0	56.6	54.8	61.4	62.9	61.1	59.5	62.4	66.4	65.9	61.6 ± 1.2
	16–18	49.9	50.9	56.5	62.7	59.7	60.3	57.8	62.6	56.7	57.8	59.1	59.0	57.7 ± 1.1
III	General	6.2	8.6	18.6	16.9	18.1	16.6	17.2	17.4	15.5	12.5	10.6	10.0	14.0 ± 1.2
	10–12	2.8	7.8	12.6	10.4	12.0	12.8	9.6	13.4	9.9	6.5	5.0	4.0	8.9 ± 1.1
	13–15	4.6	8.7	24.6	22.8	23.3	18.7	18.8	18.3	16.9	14.6	11.2	11.1	16.1 ± 1.8
	16–18	10.7	10.0	17.1	14.0	16.1	17.5	23.8	21.7	19.8	16.6	16.4	15.1	16.6 ± 1.2

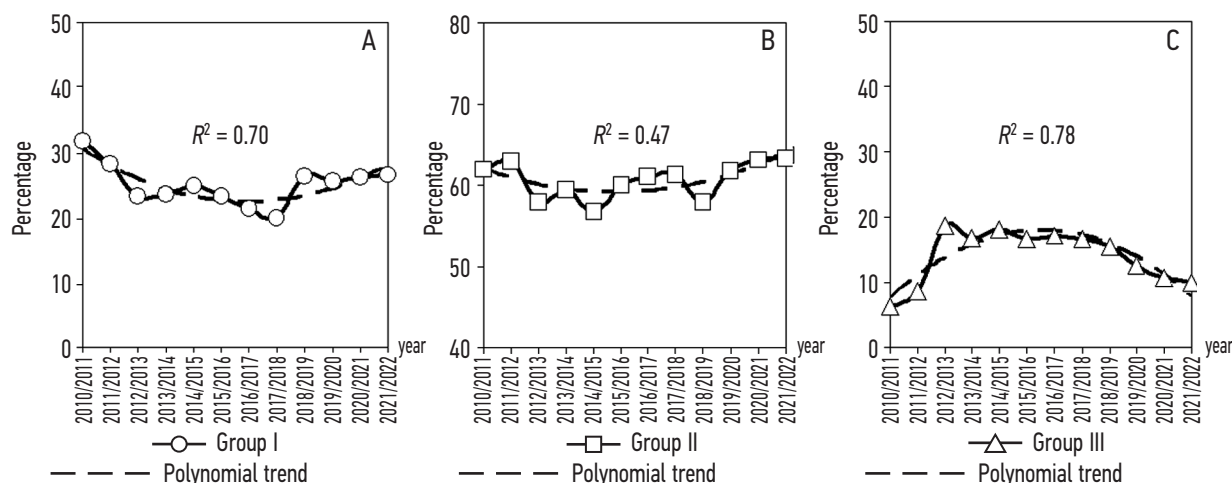


Fig. 1. Dynamics of health groups of pupils of general education organizations of the Russian Ministry of Defense
Рис. 1. Динамика групп здоровья воспитанников общеобразовательных организаций Минобороны России

The correlation between the dynamics of health indicators for pupils in groups I and II is not significant ($r = 0.326$; $p > 0.05$), whereas it is strong, statistically significant, and negative in group III ($r = -0.869$; $p < 0.001$). This suggests that different factors may influence health optimization. Given that the organization of the educational process in general educational organizations of the Russian Ministry of Defense was similar for all pupils, other factors, such as the age of the pupils, may have played a significant role.

Table 2 presents the levels of health groups among pupils in different age cohorts. There were significantly more students in health group I in the 10–12 age group than in the 13–15 age group ($p < 0.001$). Among pupils aged 16–18 years, there were significantly fewer adolescents with health group II and more with health group III than those aged 10–12 and 13–15 years (Table 2). This phenomenon requires further research.

Figure 2 shows the polynomial trends with significant coefficients of determination in the dynamics of pupils aged 10–12 years. In group I, there is an increase in data, and in group II, there is a U-curve with an increasing trend in the last period of observation. In group III, an inverted U-curve with maximum indicators in

2012/2013–2017/2018 and decreasing indicators in the last years of observation was noted. The presented indicators reveal an improvement in the health status of pupils aged 10–12 during their education. For instance, in 2010/2011, 24.6% of pupils in this age group were in health group I. In 2021/2022, this number increased to 32.5%, indicating a 7.9% improvement. Additionally, a decrease was observed in the number of students in group II, from 72.6% to 63.5% (a 9.1% decrease), and an increase in group III from 2.8% to 4% (a 1.2% increase). The living conditions and educational process in the educational organizations of the Russian Ministry of Defense may have positively impacted the adaptation process of the younger age cohort’s organism. However, 4% of students in this age group experience overstrain and depletion of functional reserves. Therefore, a personalized approach to medical and psychological support of students is critical.

The polynomial trends with significant coefficients of determination in the dynamics of pupils in health groups I (Fig. 3, A) and II (Fig. 3, B) aged 13–15 years show a U-curve with increasing indicators in the last period of observation. In health group III (Fig. 3, C), an inverted U-curve is observed with maximum indicators in

Table 2. Health groups in age cohorts of pupils

Таблица 2. Группы здоровья в возрастных когортах воспитанников

Age of pupils, years	Health group, %		
	I	II	III
10–12 (1)	29.2 ± 0.9	61.9 ± 1.2	8.9 ± 1.1
13–15 (2)	22.3 ± 0.9	61.6 ± 1.2	16.1 ± 1.8
16–18 (3)	25.7 ± 2.0	57.7 ± 1.1	16.6 ± 1.2
Significance	$p_{1-2} < 0.001$	$p_{1-3} < 0.05$ $p_{2-3} < 0.05$	$p_{1-2} < 0.001$

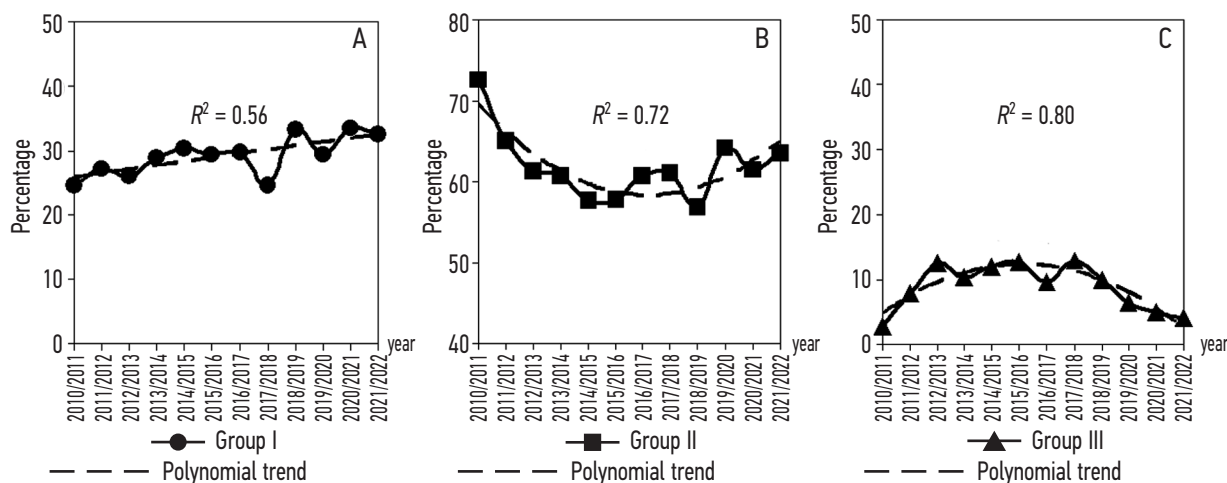


Fig. 2. Dynamics of health groups of pupils aged 10–12 years educational organizations of the Russian Ministry of Defense

Рис. 2. Динамика групп здоровья воспитанников общеобразовательных организаций Минобороны России в возрасте 10–12 лет

2012/2013–2014/2015 and a decreasing proportion in the last years of observation.

Owing to the fact that this age cohort prevailed among all pupils, the development of their health assessments resembled the general health dynamics in all general educational organizations of the Russian Ministry of Defense (Fig. 1).

In 2010/2011, 29.7% of children in this age group were classified as belonging to health group I. By 2021/2022, this percentage had decreased to 23% (a 7.7% decrease). For health group II, the percentage increased from 65.7% to 65.9% (a 0.2% increase). For health group III, the percentage increased from 10.7% to 15.1% (a 4.4% increase).

The polynomial trend for pupils aged 16–18 years in health group I (Fig. 4, A) showed a *U*-curve with minimal data in 2016/2017–2017/2018 and an increase in indicators in the last period of observation. The polynomial

trends for pupils in health groups II (Fig. 4, B) and III (Fig. 4, C) revealed an inverted *U*-curve with an increase in indicators in the last years of observation.

In 2010/2011, 34.9% of pupils in this age group were in health group I. By 2021/2022, this number had decreased to 25.9% (a 9% decrease). For health group II, the percentage increased from 65.7% to 65.9%. In health group III, the percentage increased from 10.7% to 15.1% (a 4.4% increase). Health assessments in each educational organization should be further analyzed to identify the specific reasons for this phenomenon.

CONCLUSIONS

The analysis reveals that in the academic years 2010/2011 to 2021/2022, the percentage of pupils in health group I was $25.3\% \pm 0.9\%$; in group II, it was $60.7\% \pm 0.6\%$; and in group III, it was $14.0\% \pm 1.2\%$ in

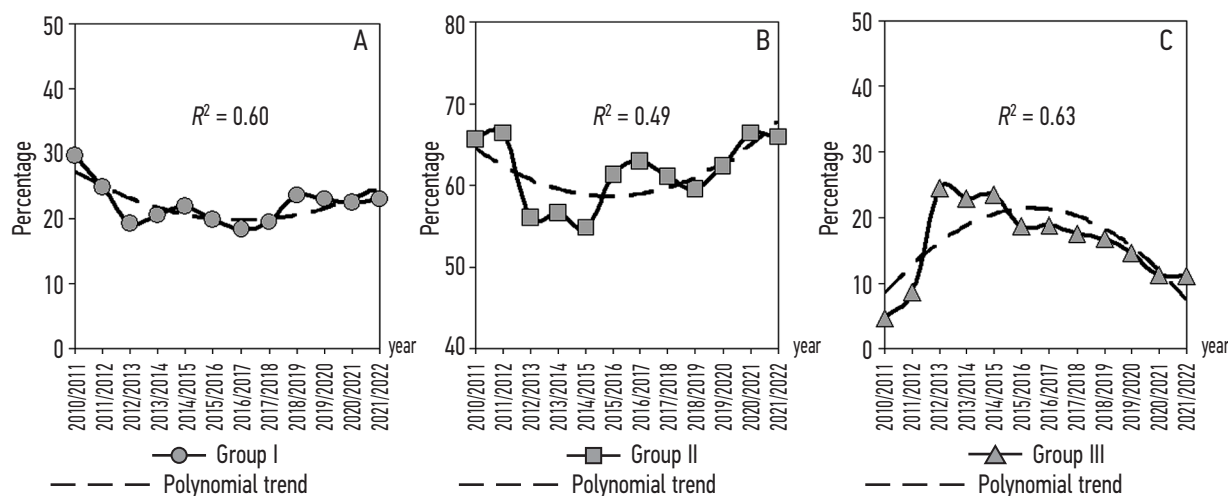


Fig. 3. Dynamics of health groups of pupils aged 13–15 years of educational organizations of the Russian Ministry of Defense
Рис. 3. Динамика групп здоровья воспитанников общеобразовательных организаций Минобороны России в возрасте 13–15 лет

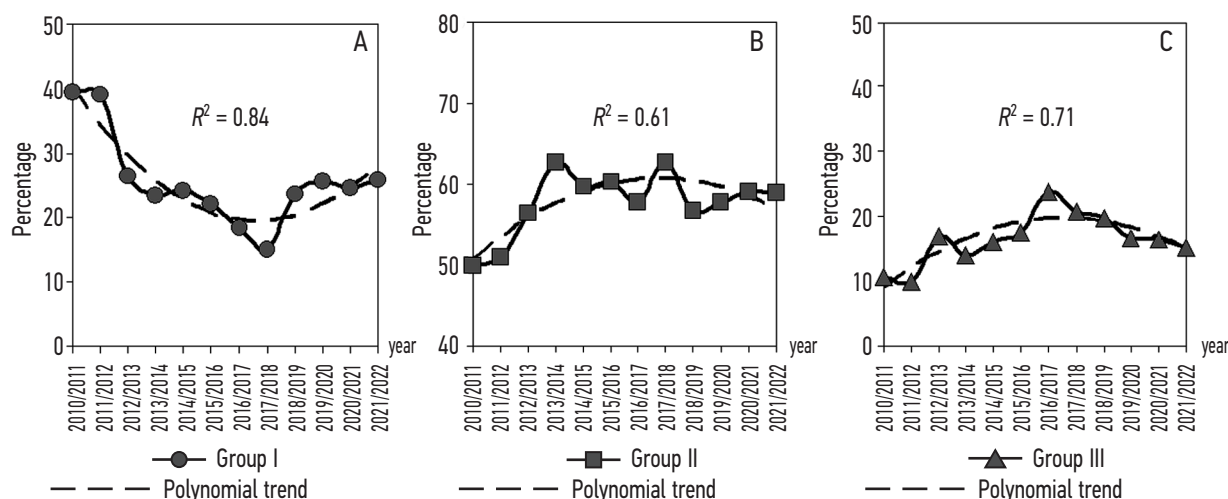


Fig. 4. Dynamics of health groups of pupils aged 16–18 years educational organizations of the Russian Ministry of Defense
Рис. 4. Динамика групп здоровья воспитанников общеобразовательных организаций Минобороны России в возрасте 16–18 лет

general educational organizations of the Russian Ministry of Defense. A recent trend of increasing the number of pupils in health groups I and II while decreasing the number in group III has been noted. These results generally indicate a well-organized educational process and optimized medical support for pupils.

The health status of pupils aged 10–12 years showed the most optimal dynamics. Among them, the majority were in health groups I and II, accounting for $29.2\% \pm 0.9\%$ and $61.9\% \pm 1.2\%$, respectively, whereas fewer were in group III, accounting for $8.9\% \pm 1.1\%$. During the last period of observation, the proportion of pupils increased in health groups I and II and decreased in group III.

The health assessments of pupils aged 16–18 years showed less pronounced indicators. The percentage of pupils in health group I was $25.7\% \pm 2.0\%$; in group II, $57.7\% \pm 1.1\%$; and in group III, $16.6\% \pm 1.2\%$. A decrease was found in the percentage of persons in health group I and an increase in group III compared to previous years in this age group.

During the study period, certain general educational organizations within the Russian Ministry of Defense exhibited unfavorable trends in the organization of medical follow-up for students. This highlights the need for more personalized attention to students. Regrettably, errors were found in the completion of medical record-keeping

and reporting forms, which may compromise the accuracy of results.

ADDITIONAL INFORMATION

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Ethical review. The study was approved by the local ethical committee of the Kirov Military Medical Academy of the Ministry of Defense of the Russian Federation.

Authors' contributions. All authors confirm that their authorship meets the ICMJE international criteria (all authors made substantial contributions to the conception, research and preparation of the article, read and approved the final version before publication). The largest contribution is distributed as follows: I. K. Soldatov, collection and processing of primary data, editing of the final version of the article; V. I. Evdokimov, analysis of results, preparation of illustrative material, writing the first version of the article; V. G. Arsentiev, methodology and design of the study, analysis of literary data, editing of the text of the article; R. G. Makiev, analysis of results, editing of the final version of the article; V. Y. Golovinova, editing of the text of the article and processing of illustrative materials.

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AUTHORS' INFO

***Ivan K. Soldatov**, MD, Cand. Sci. (Medicine), Associate Professor; address: 6, Akademika Lebedeva str., Saint Petersburg, 194044, Russia; ORCID: 0000-0001-8740-9092; eLibrary SPIN: 1503-1278; Author ID: 884724; Scopus Author ID: 57195325408; Researcher Id: A-9339-2017

Vladimir I. Evdokimov, MD, Dr. Sci. (Medicine), Professor; ORCID: 0000-0002-0771-2102; eLibrary SPIN: 1692-4593; AuthorID: 653770; Scopus Author ID: 57195325408; e-mail: 9334616@mail.ru

Vadim G. Arsentiev, MD, Dr. Sci. (Medicine), Professor; ORCID: 0000-0002-3135-0412; eLibrary SPIN: 1186-9388; Scopus Author ID: 57195258820; e-mail: rainman63@mail.ru

Ruslan G. Makiev, MD, Dr. Sci. (Medicine), Associate Professor; ORCID: 0000-0002-2180-6885; eLibrary SPIN: 4703-5573; Scopus Author ID: 55608407300; ResearcherId: H-5443-2018

Veronika Y. Golovinova, MD, Cand. Sci. (Medicine); ORCID: 0000-0002-7584-4107; eLibrary SPIN: 4182-2360

* Corresponding author / Автор, ответственный за переписку

ОБ АВТОРАХ

***Иван Константинович Солдатов**, канд. мед. наук, доцент; адрес: Россия, 194044, г. Санкт-Петербург, ул. Академика Лебедева, д. 6; ORCID: 0000-0001-8740-9092; eLibrary SPIN: 1503-1278; Author ID: 884724; Scopus Author ID: 57195325408; Researcher Id: A-9339-2017

Владимир Иванович Евдокимов, докт. мед. наук, профессор; ORCID: 0000-0002-0771-2102; eLibrary SPIN: 1692-4593; AuthorID: 653770; Scopus Author ID: 57195325408; e-mail: 9334616@mail.ru

Вадим Геннадьевич Арсентьев, докт. мед. наук, профессор; ORCID: 0000-0002-3135-0412; eLibrary SPIN: 1186-9388; Scopus Author ID: 57195258820; e-mail: rainman63@mail.ru

Руслан Гайозович Макиев, докт. мед. наук, доцент; ORCID: 0000-0002-2180-6885; eLibrary SPIN: 4703-5573; Scopus Author ID: 55608407300; ResearcherId: H-5443-2018

Вероника Юрьевна Головинова, канд. мед. наук; ORCID: 0000-0002-7584-4107; eLibrary SPIN: 4182-2360