THE STATE OF HEALTH OF 1ST-, 2ND-, AND 3RD-YEAR STUDENTS OF A MEDICAL UNIVERSITY

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Today, preserving the health of medical students, who constitute the labor pool for Russia's healthcare system, is a strategically important task for both the state and society. The purpose of this work was to investigate the status of health of 1st-, 2nd-, and 3rd-year students of Pacific State Medical University of the Ministry of Health of the Russian Federation. The students underwent a comprehensive examination at the beginning and at the end of the academic year. All in all, we examined 698 people in 2022 and 516 people in 2023. The examination was physical, focusing on the functional state of the cardiorespiratory system, and also assessed the participants' mental health. Primary medical documentation was used as a source of information to assess the incidence of temporary disability and chronic non-communicable diseases of students. Data comparison was done using nonparametric statistical methods. The differences were considered statistically significant at $p < 0.05$. We revealed a downward trend for the students' health indicators, which confirms their allocation into health status groups. At the beginning of the academic year, the 1st group was the largest, and by its end, the share of those reallocated to the 3rd group was significant, with the group including 33.1% of make participants and 36.8% of female participants. This study substantiates the need for continued monitoring of the health status of students. The resulting data enable assessment of the students' health status and identification of priority preventive measures to be developed to preserve their health.

Keywords: students, physical development, mental health, morbidity with temporary disability, chronic non-communicable diseases, health groups

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Compliance with ethical standards: the study was conducted in accordance with the Helsinki Declaration of the World Medical Association and approved by the Interdisciplinary Ethics Committee of the Russian Ministry of Health (protocol No. 7 of March 27, 2023). All participants have voluntarily signed informed consent forms.

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СОСТОЯНИЕ ЗДОРОВЬЯ СОВРЕМЕННЫХ СТУДЕНТОВ МЛАДШИХ КУРСОВ МЕДИЦИНСКОГО ВУЗА

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В современных социально-экономических условиях проблема сохранения здоровья студентов-медиков как основного резерва кадров системы здравоохранения Российской Федерации имеет стратегическое значение, как для государства, так и для общества в целом. Целью работы было исследовать здоровье студентов ФГБОУ ВО ТГМУ Минздрава России 1–3 курсов. Выполнена комплексная оценка состояния здоровья студентов младших курсов в начале и в конце учебного года. Всего обследовано 698 человек в 2022 г. и 516 человек в 2023 г. Оценено физическое развитие студентов. Изучены показатели функционального состояния кардиореспираторной системы, а также состояние их психического здоровья. Для оценки показателей заболеваемости с временной утратой трудоспособности и хронической неинфекционной заболеваемости студентов в качестве источника информации использована первичная медицинская документация. Сравнительный анализ полученных данных проводили с применением методов непараметрической статистики. Статистическая значимость различий определялась при $p < 0,05$. Выявлена тенденция к ухудшению показателей, характеризующих состояние здоровья студентов, что подтверждает распределение их по группам здоровья. Если в начале учебного года преобладали обучающиеся с первой группой здоровья, то в конце учебного года процент студентов с третьей группой значительно возрос и составлял 33,1% у юношей, 36,8% у девушек. Проведенное исследование указывает на необходимость дальнейшего наблюдения за показателями состояния здоровья студентов. Полученные данные позволяют оценить состояние здоровья студентов и определить приоритетные направления разработки профилактических мер для сохранения их здоровья.

Ключевые слова: студенты, физическое развитие, психическое здоровье, заболеваемость с временной утратой трудоспособности, хронические неинфекционные заболевания, группы здоровья

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Соблюдение этических стандартов: исследование проведено в соответствии с Хельсинской декларацией Всемирной медицинской ассоциации и одобрено междисциплинарным комитетом по этике ФГБОУ ВО ТГМУ Минздрава России (протокол № 7 от 27 марта 2023 г.). Все участники подписали добровольное информированное согласие на участие в исследовании.

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Today, preserving the health of medical students, the labor pool for Russia's healthcare system, is a strategic task for both the state and society [1–5]. Receiving a medical education involves significant mental efforts, labor inputs, exposure to potentially hazardous factors of hospital environments, all of which affect organisms of students, with all the anatomical and physiological specifics of a young age [6–8].

Health status has a direct effect on the students' performance, grades, motivation, and the quality of learning the professional skills. This is most relevant for those in the 1st, 2nd, and 3rd

years, since they often struggle with mastering general cultural and professional competencies [6, 9–10].

Recent studies have revealed that the health of medical students is generally deteriorating: the prevalence of chronic diseases and functional abnormalities is increasing, while indicators of physical development and fitness are declining [6, 7, 11]. Researchers report that mental conditions are on the rise; up to 54% of them are nosological, concomitant neurotic reactions with discernible symptoms [7]. The number of students signed up to the special physical culture curriculum because of poor health is increasing every year [1, 4], and in some universities, it reaches almost 50% of all those attending the classes [12].

The health status of students is an objective indicator that allows assessing the effectiveness of the already implemented hygiene measures and formulates the directions of further activities [13]. Annual medical examinations that show how healthy the students of the country are support overall health preservation efforts designed for this population.

The purpose of this work was to investigate the status of health of 1st-, 2nd-, and 3rd-year students of Pacific State Medical University of the Ministry of Health of the Russian Federation.

PATIENTS AND METHODS

Using the "Methodological recommendations for a comprehensive assessment of students' health based on the results of medical examinations" [13], we assessed the health of 1st-, 2nd-, and 3rd-year students of Pacific State Medical University, collecting the data twice, at the beginning and at the end of the academic year. There were 698 participants (25.5% males, 74.5% females) in 2022 (beginning of the academic year) and 516 participants (31.2% males, 68.8% females) in 2023 (end of the academic year). Height (body length) and weight were measured against regional regression scales to assess the level of physical development (PD) [14]. In addition, we analyzed the functional state of the cardiorespiratory system: vital lung capacity (VC), heart rate (HR), blood pressure (BP), Myocardium and Rhythm indices. Using the Hamilton Depression Rating Scale (HDRS) and Khanin's adaptation of Spielberg state-trait anxiety inventory [15, 16], we have also evaluated the mental health status of 176 1st-year students (30.1% males, 69.9% females). In addition, medical reports (form 025-TsZ/u) were analyzed with the aim to establish values of the indicators reflecting the incidence of temporary disability (TD) and chronic non-communicable diseases (CNCD) among students of the 1st, 2nd, and 3rd years.

For statistical analysis of the data, we used StatTech v.4.7.3 (StatTech; Russia). Categorical data are given as absolute values and percentages. For comparative analysis, we used nonparametric statistical methods. Pearson's chi-squared test (χ^2) was used to compare percentages in multifield conjugacy tables, and Holm method for multiple comparisons. The differences were considered statistically significant at $p < 0.05$.

RESULTS

The collected data indicate that 46.1% of male participants had harmonious PD at the beginning of the academic year, and by the end thereof, this figure dropped to 43.8%. Through the academic year, the share of male participants with disharmonious PD (body weight deficiency) decreased by 8.1%, which is significant ($p = 0.05$), but the proportion of male students whose PD was sharply disharmonious due to body weight deficiency has grown by 6.6% ($p = 0.06$), which was not significant but very close to the threshold value. At the same time, disharmonious and sharply disharmonious PD due to overweight was registered in 23.0% of young men at the beginning and 26.9% at the end of the academic year. The share of female participants whose PD was harmonious remained virtually unchanged through the academic, and was 56.4% at the beginning and 52.5% at the end of thereof. Body weight deficiency as a reason of disharmonious PD was 4.5 times more common than overweight. By the end of the academic year, the proportion of overweight female students (varying severity) increased only slightly, from 15.4% to 18.8%.

External respiration is one of the most important health characteristics. It was found that the vast majority of 1st-, 2nd-, and 3rd-year students (91.6% of males and 88.1% of females) had normal VC, and this indicator did not change through the academic year.

The cardiovascular system (CVS), which provides all organs and systems with oxygen and nutrients, largely determines the adaptive capabilities of the whole organism. Heart rate is an important indicator of the functioning of both the cardiovascular and nervous systems. The majority of the examined students (60.0%) had normal heart rate, and one third exhibited tachycardia. Bradycardia was diagnosed in 9.6% of males and 3.3% of females. While the number of male students with normal indicators and various deviations from the norm remained unchanged through the academic year, the number of female students with bradycardia increased significantly to 7.6% ($p = 0.003$).

At the end of the academic, blood pressure was within the physiologically normal range in 87.5% of male and 82.9% of female participants. In males, it did not change significantly throughout the study period; by the end of the of the academic year, hypotension-type blood pressure deviations amounted to 3.8% of cases for SBP and 1.3% for DBP, while for the hypertension-type blood pressure deviations the respective figures were 8.8% for SBP and 9.4% for DBP. In the female cohort, by the end of the academic year, the share of participants with normal SBP dropped from 89.6% to 82.9% ($\chi^2 = 8.58$; $p < 0.01$), that with normal DBP — from 88.9% to 83.4% ($\chi^2 = 5.37$; $p = 0.02$). At the same time, the proportion of female students with hypertension-type SBP disorders rose from 3.7% to 8.2% ($\chi^2 = 8.59$; $p < 0.01$) same type DBP disorders — from 10.0% to 14.6% ($\chi^2 = 4.29$; $p = 0.04$). It is noteworthy that by the end of the academic year, the frequency of registration of hypotension-type SBP deviations in males was 2.4 times lower than in females ($\chi^2 = 4.61$; $p = 0.03$).

Examinations under the Myocardium and Rhythm indices revealed a significant decrease of the number of students with normal indicators for the former index, 44.9% to 32.5% in the male cohort ($p = 0.02$), and from 41.7% to 32.6% in the female cohort ($p = 0.01$). The functional state of the cardiovascular system was borderline in more than half of the participants at the beginning of the academic year, and it increased to over 60.0% by the end thereof in both sex cohorts.

During the academic year, the number of male participants who had the Rhythm index indicators verging upon being abnormal increased significantly, from 4.5% to 13.1% ($p < 0.01$). In addition, the proportion of female participants whose Rhythm indicators deviated from the norm slightly increased significantly (from 62.1% to 69.4% ($p = 0.03$)), while the number of girls with normal values of this index decreased (from 30.0% to 21.6% ($p < 0.01$)). It should be noted that by the end of the spring semester, normal Rhythm index was registered

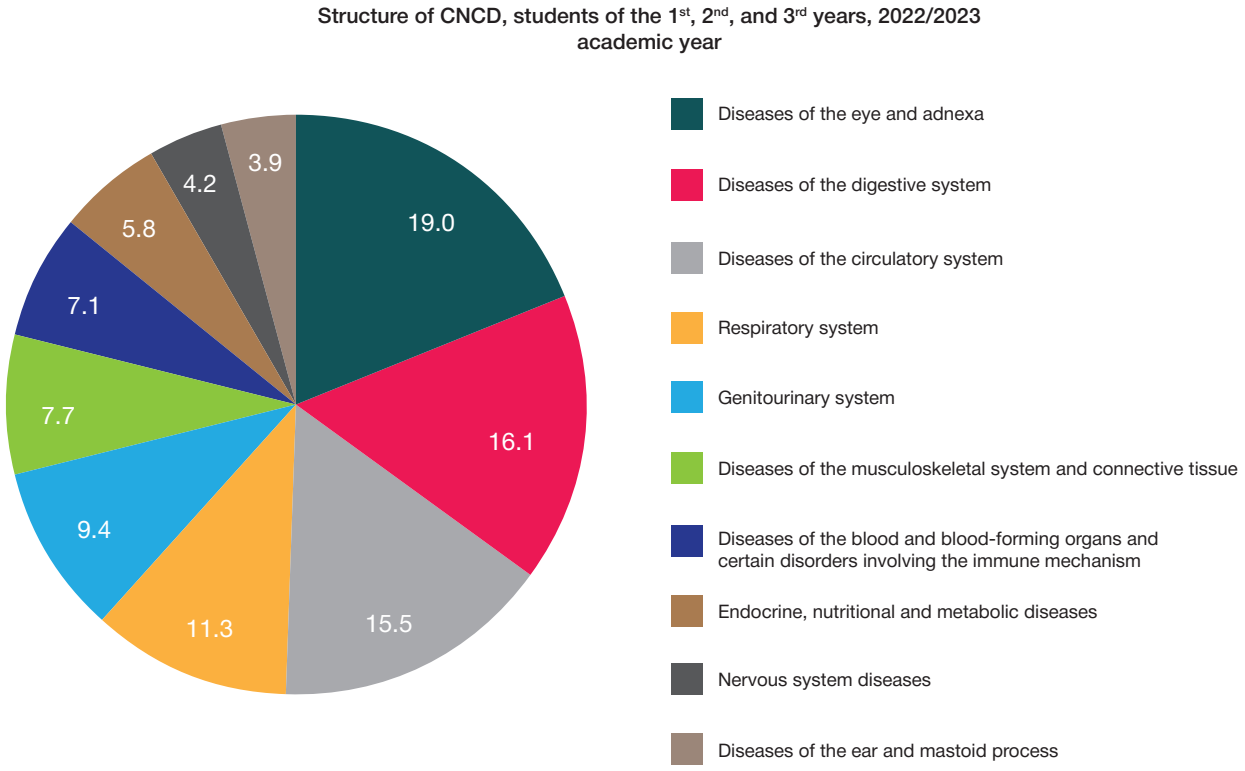

Fig. Structure of CNCD, students of the 1st, 2nd, and 3rd years (%)

only in 23.8% of male and 21.6% of female participants. In the female cohort, slight deviations from the normal values of this index were detected thrice as often as in the male cohort.

In the 2022/2023 academic year, 14.5 cases per 100 participants (mean) involved ailments causing TD, with the respective figure among the 3rd-year students being 17.5 cases, that among the 2nd-year students — 13.6 cases, and among the 1st-year students — 12.5 cases. Respiratory diseases, including acute respiratory viral infections, were the main reason for medical absences. Overall, the number of academic days skipped because of them was 73 per 100 students. The average duration of a sick leave was 8.9 days. It was also revealed that male students (all years) were less likely to seek medical assistance in a clinic than female students (44.0% and 56.0%, respectively; $\chi^2 = 4.5$; $p = 0.05$).

As for the structure of incidence of TD-causing ailments, the most common nosology was respiratory diseases, including acute respiratory viral infections (ARVI): 56.3%. The second most common reason were disorders of the musculoskeletal system (12.3%), the third — digestive system diseases (10.9%).

As for CNCD, in the 2022/2023 academic year students of the 1st, 2nd, and 3rd years most often suffered from the diseases of the eye and adnexa, digestive organs and circulatory system (Fig.).

The results of the comparative assessment of mental health of 1st-year students revealed that depressive disorder was 1.6 more common in females than in males ($p = 0.02$). Moderate trait anxiety was found to affect 54.7% of male and 56.1% of female 1st-year students, low trait anxiety — only 22.6% of males and 14.6% of females, and high trait anxiety — 77.4% of males and 85.4% of females. At the same time, about one in four first-year students exhibited symptoms of moderate reactive anxiety, and high reactive anxiety was registered only in 6.5% of the participating girls.

Based on the results of medical examination, 1st-, 2nd-, and 3rd-year students of Pacific State Medical University were distributed into health status groups (Table 1).

According to the data, at the beginning of the academic year, the majority of 1st-, 2nd-, and 3rd-year students were classified in the first health status group. However, by the end of the academic year, the proportion of healthy students decreased significantly: by 29.2% among male participants ($\chi^2 = 29.76$; $p < 0.01$), and by 24.7% among female participants ($p < 0.01$). We have registered a growing number of those reclassified into second and third health status groups, with the amount of students meeting the criteria of the third group being significant among both boys and girls ($p < 0.01$).

Table 1. Distribution of students into health status groups

Health status groups	Males				*p*-value	Females				*p*-value
	Academic year start		Academic year end			Academic year start		Academic year end		
	Abs.	%	Abs.	%		Abs.	%	Abs.	%	
First	102	57.3	45	28.1	< 0.001	298	57.3	116	32.6	< 0.001
Second	50	28.1	58	36.3	0.1	154	29.6	107	30.1	0.89
Third	23	12.9	53	33.1	< 0.001	67	12.9	131	36.8	< 0.001
Fourth	3	1.7	4	2.5	0.62	1	0.2	2	0.6	0.34
Fifth	–	–	–	–	–	–	–	–	–	–

Note: * — differences in indicators are statistically significant ($p < 0.05$).

Table 2. Classification of students into health status groups, by year (%)

Year	Period	*n*	Health status groups			
			First	Second	Third	Fourth
1	Start	368	54.3	32.3	13.0	0.3
	End	295	36.6	29.8	32.2	1.4
	χ^2		20.98	0.49	35.77	2.53
	p-value		< 0.001*	0.48	< 0.001*	0.11
2	Start	180	56.7	28.3	14.4	0.6
	End	104	26.9	33.7	38.5	1
	χ^2		23.38	0.9	20.9	0.17
	p-value		< 0.001*	0.34	< 0.001*	0.68
3	Start	150	65.3	22.7	10.7	1.3
	End	117	21.4	35.9	41.9	0.9
	χ^2		50.17	5.57	34.17	0.13
	p-value		< 0.001*	0.02*	< 0.001*	0.72
p-value	Academic year start		$p1_{\text{year 1 – year 3 (HSG I)}} = 0.02^*$; $p1_{\text{year 1 – year 3 (HSG II)}} = 0.03^*$			
	Academic year end		$p1_{\text{year 1 – year 3 (HSG I)}} = 0.003^*$			

Note: * — significant differences ($p < 0.05$).

A comprehensive assessment of the health status of 1st-, 2nd-, and 3rd-year students showed that even within one academic year, it deteriorates to the point of reclassification (Table 2).

At the beginning of the academic year, there were significantly more 1st-year students in the first and second health status groups ($p = 0.02$ and $p = 0.03$, respectively) than 3rd-year students. However, there were no significant differences in distribution of 2nd- and 3rd-year students into health groups. At the end of the academic year, the number of 3rd-year students belonging in the first health status group decreased significantly, while the number of 3rd-year students classified into the second and third health status groups increased significantly.

DISCUSSION

The results of previous studies indicate that the majority of students have harmonious PD. However, the percentage of students with disharmonious and sharply disharmonious PD remains fairly high [17]. For example, 17.0% of students of Pirogov Russian National Research Medical University have disharmonious PD, and 9.0% — sharply disharmonious [18]. At the same time, our study has shown that by the end of the academic year, 56.3% of boys and 47.5% of girls have abnormal PD.

According to the collected data, various functional disorders of hemodynamics were detected in students both at the beginning and at the end of the academic year. For example, by the end of the year, hypertension-type SBP deviations were registered in 8.8% of male participants and 8.2% of female participants, and hypertension-type DBP deviations — in 9.4% of boys and 14.6% of girls. For comparison, the assessment of blood pressure indicators of students of the Medical Faculty of Kabardino-Balkarian State University revealed hypertension only in 3.1% of cases [19].

Our work has also confirmed the data from other studies indicating that 1st-, 2nd-, and 3rd-year students most often seek medical help with respiratory diseases [20]. The prevailing chronic pathologies among the Pacific State Medical University students were diseases of the eye, digestive, and cardiovascular systems. At the same time, according to the literature, students of the Russian medical universities most often suffer from "respiratory diseases, accounting for about 18.0%, followed by the musculoskeletal system diseases and diseases of the eye and are in second place, and diseases of the eye and adnexa [21].

In our work, we observed a tendency towards developing depressive disorders of varying degrees, as well as high levels of trait and reactive anxiety among students; these findings are consistent with reports from other researchers [22–24]. For example, a study conducted in Voronezh State Medical University named after N.N. Burdenko revealed that in the fall semester, 6.0% of students had low state anxiety, 51.0% were classified as having a moderate version thereof, and 43.0% of the respondents had high state anxiety. As for trait anxiety, only 24% of the participants had it at a high level, and 76.0% experienced moderate trait anxiety [23].

Our work revealed a gradual deterioration of health indicators of 1st-, 2nd-, and 3rd-year students of Pacific State Medical University, which is confirmed by their distribution into health status groups. At the beginning of the academic year, the first health status group was the largest, but at the end of the academic year, the percentage of students with chronic diseases in the compensation stage, which puts them into the third health status group, increased significantly and amounted to 33.1% for boys and 36.8% for girls. Thus, over the course of the study, the number of practically healthy students decreased twofold. For comparison, we give data on classification of students of a medical academy into health status groups: first group — from 23.8 to 30.0%, second group — from 32.8 to 40.0%, third group — from 30.0 to 43.4%" [25].

This study substantiates the need for continued monitoring of the health status of students. The resulting data enable assessment of the students' health status and identification of priority preventive measures to be developed to preserve their health.

It is particularly important to identify students belonging in the first (practically healthy) and second (various functional or morphological changes) health status groups, since the former may be in a borderline condition, between being healthy and ill. Diagnosing, preventing, and curing these states is the most important task of medical science and practical healthcare. Moreover, timely implementation of several preventive and remedial

measures can facilitate the transition of students from the second group to the first one.

CONCLUSIONS

The comprehensive examination of health status of 1st-, 2nd-, and 3rd-year students of a medical university revealed negative trends. More than half of the students (50.2%) have disharmonious and sharply disharmonious physical development, mainly due to body weight deficiency. By the end of the academic year, their cardiovascular system deteriorates functionally, with the number of students scoring within the normal range of Myocardium and Rhythm indices decreasing significantly ($p < 0.01$). The prevalence of diseases causing TD was established as high, and female students are more likely to seek medical help (56.0% vs. 44.0%, $\chi^2 = 4.5$; $p = 0.05$). The most common of such diseases are those of the respiratory system (56.3%), musculoskeletal system (12.3%), and digestive system (10.9%). As for CNCD, the leading ailments were diseases of the eye and adnexa (19.0%), digestive organs (16.1%), and circulatory system (15.5%). The level of trait anxiety was found to be high in 77.4% of boys and 85.4% of girls, and 12.9% of boys and 20.7% of girls had depressive disorders. The proportion of those belonging in the first health status group was significantly higher among 1st-year students compared to their 3rd-year fellows ($p = 0.003$). Movement through the years is associated with a significant growth of the number of students classified into the third health status group ($p < 0.01$). The data resulting from this study form the basis for the development of targeted preventive measures aimed at preserving and strengthening the health of students.

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