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Non-Medications in the Health Care System of Student Youth

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***Abstract* — Human health determines the breadth of the range of social activities. The realization of the psychophysical potential of the young generation depends on the state of health, which determines the basis for the future economic and demographic development of the state, which ultimately affects the national security of the country and the determination of the geopolitical direction in the formation of modern architecture of the multipolar world. The health status of a high school graduate determines its success in the learning process and its relevance in the labor market. Severe conditions of general informatization compact the living space of modern youth, the learning process of which is becoming more and more dynamic. Increasing competition of the intellectual labor market and at the same time, a sedentary lifestyle of modern people place higher demands on the health status of students. Therefore, the leadership of universities is obliged to solve the problems of both vocational education of students and the issues of preserving, strengthening and enhancing the health of future specialists on the basis of the formation of a modern model of students' personal development, focused on a healthy lifestyle and the acquisition of value-added health-saving competencies. Higher school management should find ways to optimize the learning process by incorporating innovative technologies into the health care system of a given socio-demographic group, which is most susceptible to the aggressive effects of numerous risk factors. The leadership of a higher school should take into account the role and importance of physical culture in the design of the educational space of higher educational institutions.**

Keywords* — *social health, monitoring, physical health, students

I. INTRODUCTION

In Russia, for two decades at the end of the twentieth century and at the turn of the new millennium, demographic changes are mainly regressive, which affects the development of modern society. In general, these changes were due to high morbidity, mortality, low birth rates, the life expectancy of the population, depending on economic indicators of per capita income, the proportion of residents with incomes below the subsistence level, and the availability of health care resources. The current situation affected the shortage of labor in our country at the present time, which, of course, predetermined the search for ways to use innovative technologies in protecting the public's health both on the part of government agencies as a whole and on the part of educational organizations responsible for providing the country with new highly qualified by specialists.

Over the past decade, the Government of the Russian Federation has been implementing socially-oriented projects in the field of healthcare, education, housing, and programs for long-term demographic policy. These socially-oriented projects provide for the development of a preventive direction in medicine, an increase in material investments in the social sphere, and youth policy. The purpose of such transformations is the formation of the correct moral guidelines and life values of youth. The effective healing of the population as a whole is the basis for the value approach development. This approach involves the formation of responsibility and the care of each person about their health.

Recently, problems of information, environmental, and resource security have become more acute in the world. The

future well-being and economic prosperity of the state are impossible without resolving the issues of strengthening the social, mental, and physical health of the younger generation. The socio-economic development of the Russian Federation is focused on the industrial development of its eastern regions, which actualizes the issues of strengthening and maintaining the health of the population of these territories, and especially students, as the most sensitive to changes in climatic and geographical living conditions [1–3].

The solution to the strategic tasks of strengthening the health of the young generation should focus on the prevention of diseases and the elimination of risk factors. Preventive measures are designed to ensure high educational activity of students, and in the future – high professional activity and longevity of specialists.

Recent studies have shown that one of the risk factors for public health was the intensive industrial development of territories. On the example of the Irkutsk region, it was shown that intensive industrial development of the territories led to the prolonged exposure of chemicals to both environmental objects and a significant part of the region's population [4]. The authors analyzed carcinogenic risks for the population (the living conditions of the population in industrial centers and rural areas were compared). As a result of the analysis, the authors concluded that the residents of urbanized regions of the region are at the most significant carcinogenic risk. The authors found that the priority method of prevention is the inhalation route of exposure to carcinogenic chemicals. Hexavalent chromium and lead contained in the atmospheric air of the Irkutsk Region (among other congeneric risk factors for public health) cause serious harm to the state of public health. Hexavalent chromium and lead in atmospheric air occupy one of the first places in the list of carcinogenic components of atmospheric air [5].

The maximum allowable concentration of chromium in the air is 0.01 mg / m^3. Even with a slight excess of the threshold for the concentration of chromium in the air, chromium causes severe damage to the respiratory tract, diseases of the gastrointestinal tract, and severe damage to the central nervous system. Chromium compounds cause lung cancer and various allergies.

Chromium is present not only in the air; it accumulates in water and soil. Compounds of chromium and other heavy metals occur through the release of metals into the environment due to human-made emissions. This combination of chromium with metals is a great danger to ecosystems. An increase in chromium concentration harms many aquatic organisms cultivated in the water of Lake Baikal, destroys its flora and fauna. These processes, directly and indirectly, affect the health of the population of the Baikal region.

Although chromium is a necessary and essential element of human metabolism, its high concentrations are toxic. Chromium, like some other heavy metals, has a harmful poisonous, irritating, cumulative, and mutagenic effect on the human body [6].

It was revealed that air pollution of industrial centers of the Irkutsk region adversely affects the health status of the population [7, 8]. The data are confirmed by high correlation coefficients, associating the incidence of people with the value of gross emissions of harmful substances into the air in all age groups. Moreover, in adolescents this correlation dependence is the highest and corresponds to r = 0.96, p = 0.00 (for comparison: in children r = 0.83, p = 0.001; in adults r = 0.87, p = 0.000).

The adverse effect of atmospheric air polluted by harmful substances is also manifested in the functional tension of the human cardiovascular system. Teenagers are related to the student audience in the age category. Young people live in conditions of chronic inhalation load, which leads to tachycardia, to a violation of blood pressure, to lagging behind the age norm of the pumping function of the heart. There is a decrease in the adaptive-adaptive capabilities of the cardiovascular system of adolescents 11-17 years old in the Irkutsk region compared to their peers living in unexposed rural settlements, remote from industrial sources of pollution [9–11].

All this actualizes the search for ways to improve the health of student youth, most of which are concentrated in the industrial regions of the Irkutsk region, which are unfavorable concerning environmental safety. The leadership of universities in the Irkutsk region has a priority to address the issues of strengthening the health of future specialists, which in the long term will affect the economic development of the region and maintaining its healthy gene pool.

II. Materials and Methods

In the Irkutsk National Research Technical University over the past decade, the number of students assigned to the III functional group due to health reasons has increased. In 2008, 24.7 % of first-year students were included in this group of students [12], at the beginning of the 2018-2019 academic year, its quantitative composition remained practically unchanged – 24.8 % of students (Table 1). Moreover, a significant increase in the size of the leading group is evident. The peak values for the number of fillings of first-year students of the third functional group were in 2011 (35.7 %), 2013 (38.1 %), and 2017 (30.4 %). At the same time, it should be noted that the number of functional group IV decreases from 9.3 % in 2008 to 1.77 % in 2017 and 1.9 % in 2018.

TABLE I. Functional groups of students 1 and 3 courses

I course						
Health groups	***2008***		***2013***		***2018***	
	number of people	%	number of people	%	number of people	%
function group 1	1682	53.3	909	50.6	1378	65.5
function group 2	386	12.7	128	7.1	121	5.7
function group 3	836	24.7	685	38.1	523	24.8
function group 4	296	9.3	72	4.1	84	4.0
III course						
function group 1	780	45.8	426	37.9	663	54.8
function group 2	326	19.1	60	5.3	34	2.8
function group 3	447	26.2	513	45.6	489	40.4
function group 4	149	8.7	125	11.1	24	2.0

Moreover, as statistics show, over a ten-year observation period only in 2018, third-year students improved their redistribution among functional groups: the quantitative composition of the leading group increased due to a significant reduction in “problematic” ones.

An analysis of the nosologies of students of the Irkutsk National Research Technical University indicates the leading position of cardiovascular diseases: if in 2008 the number of cardiovascular diseases among students corresponded to 21.4 %, then in 2018 the number of students with this pathology increased to 28.1 %.

The rate of development of technogenic atmospheric changes is ahead of the adaptive mechanisms of the human body, which is one of the reasons for the increase in the number of diseases of the respiratory system [13]. In 2018, the number of university students with bronchopulmonary pathology increased to 19.4 %. These are mainly asthma (19.7 %), chronic bronchitis (18.6 %), pneumonia (9.1 %), and other diseases (52.6 %). The increase in students with respiratory symptoms was 11.6 % over ten years. In 2008, the number of students with diseases of the respiratory system corresponded to 7.8 %.

The dependence of diseases of the musculoskeletal system and the overall incidence of children and adolescents from technogenic pollution was confirmed on the basis of twenty-year socio-hygienic monitoring and a study of causal relationships between air pollution and soil pools in the regions of the Irkutsk region (for example, the cities of Irkutsk and Shelekhov) and children's health [14]. An increase in the incidence of the musculoskeletal system in children by 5.6 times and adolescents by 12 times has been proven. Of course, living conditions also affect the health of students: diseases of the musculoskeletal system of students of the Irkutsk National Research Technical University account for 24.3 % of students. These are mainly students with a history of scoliosis (18.1 %), osteochondrosis (26.6 %), flat feet (21.5 %), and other deviations in health status (33.8 %).

The formation of a healthy culture of students of the Irkutsk National Research Technical University is in the focus of the priority directions of the university's leadership in the process of implementing a social order for the professional development of the personality of a future specialist. During the training of students at the university, the state of their physical health, in addition to a medical examination, is examined throughout the entire training period using monitoring technologies, which are an integral part of the all-Russian public health protection system.

Since 2007, the physical development monitoring and physical fitness of students have been studied at the University's Physical Fitness Monitoring Laboratory at the University's Center for Health-saving Technologies. In essence, these data constitute the analytical basis of monitoring and serve as a starting point for making managerial decisions to correct the process of their training with a view to its optimization and in-depth individualization [15, 16]. Monitoring technologies make it possible to comprehensively monitor the dynamics of physical development and physical fitness of each student and social group.

This study covered the time range from 2008 to 2018 and was carried out based on an analysis of the results in young men of the III functional group aged 17 to 21 years, having deviations in the state of health of a permanent or temporary nature.

The level of physical development was determined using the anthropometric characteristics of students and their psychometric indicators for the functional taste of Stange and Genchi. The level of development of physical qualities underlying the determination of the degree of physical fitness of students was determined following the developed standards of physical fitness of students of the Baikal region [17] and was based on the results of control tests (Table 2).

TABLE II. PHYSICAL DEVELOPMENT OF YOUNG III FUNCTIONAL GROUP (IN THE COURSE OF TEACHING FROM 1 TO 3 COURSES)

Year university studies	Height (cm)	Weight (kg)	Chest circumference (cm)	Stange test(s)	Genchi test(s)
Beginning of I course (1)	177.4±0.3	69.8±0.5	91.6±0.7	57.7±0.8	31.7±1.3
End of I course (2)	177.2±0.5	69.5±0.9	94.2±0.3	88.2±0.6	40.6±0.8
P (1-2)	P>0.05	P>0,05	P<0.05	P<0.05	P<0.05
End of II course (3)	178.5±1.0	71.3±0.5	94.5±0.3	59.8±2.1	39.9±0.1
P (2-3)	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
End of III course (4)	179.7±1.0	76.0±2.1	95.8±1.3	62.9±0.6	33.2±0.9
P (3-4)	P>0.05	P<0.05	P>0.05	P>0.05	P<0.05

The analysis of growth values is one of the factors of indicators of physical health and has a high coefficient of genetic predetermination (up to 95 %). The analysis of growth values did not reveal significant changes. At the same time, the weight values significantly differ by the end of the third year compared with the data at the end of the second year ($P < 0.05$), which is quite understandable by the sharp decrease in students' motor volume due to the termination of practical training in physical education in the third year of study.

The increase ($P<0.05$) of the mean values of the chest circumference was determined from 91.6 ± 0.7 cm to 94.2 ± 0.3 cm. The Stange test indicators show a change from 57.7 ± 0.8 s to 88.2 ± 0.6 s according to the results of their comparison at the beginning and end of the first year of study in high school.

At the same time, the average values of the Genchi sample had significant differences twice (at $P < 0.05$). Moreover, the decrease in the values of this indicator was determined by comparing their values at the end of the second (39.9 ± 0.1 s) and third (33.2 ± 0.9 s) courses. Improvement of values was noted when comparing data at the beginning (31.7 ± 1.3 s) and the end (40.6 ± 0.8 s) of the first year of study.

An analysis of the youth's physical fitness (Table 3) showed that the value of the results in the 1000 m run has no significant differences, although there is an improvement in their characteristics when comparing data at the beginning of the first course (4: 44 ± 0.04 s) and its end (4: 32 ± 0.07 s).

Second-year students showed the best results (4: 22 ± 0.11 s). The increase in the distance (up to 4: 36 ± 0.14 s) was determined at the end of the third year of study.

TABLE III. PHYSICAL PREPAREDNESS OF YOUNG III FUNCTIONAL HEALTH GROUP(IN THE COURSE OF TRAINING FROM 1 TO 3 COURSES)

Year university studies	Pullup (number of times)	Torso lift in 30 s (number of times)	Tilt forward from starting position sitting (cm)	Push-ups (number of times)
Beginning of I course (1)	9.3±0.2	25.9±0.2	10.0±0.4	28.9±0.6
End of I course (2)	9.5±0.4	26.6±0.4	12.±0.8	29.8±1.4
P (1-2)	P>0.05	P>0.05	P<0.05	P>0.05
End of II course (3)	12.3±0.6	29.8±0.6	14.9±1.8	34.9±1.1
P (2-3)	P<0.05	P<0.05	P<0.05	P<0.01
End of III course (4)	8.8±0.7	25.8±0.7	10.1±1.6	30.7±0.6
P (3-4)	P<0.05	P<0.05	P<0.05	P<0.05

By the end of the 3rd year, there is also a slight deterioration in the results of students running 30 m (up to 4.44 ± 0.1 s) and at the same time, an improvement in the distance from the beginning of studies at the university (4.29 ± 0.05) to the end of the first (4.21 ± 0.09 s, P> 0.05) and the second (4.21 ± 0.09 s) years of study.

The trajectory of significant improvement in strength (according to the "pull-up" test to 12.3 ± 0.6 times; (P (2-3) <0.05) and speed-strength values of the indicators is similar to that in the test "trunk lift in 30 s" to 29.8 ± 0.6 times (P (2-3) <0.05). The deterioration of the results was recorded at the end of the third course up to 8.8 ± 0.7 times in the pull-up test and up to 25.8 ± 0.7 times (P (3-4) <0.05) in the test "torso lifting for 30 s "(P (3-4) <0.05).

An improvement in the strength characteristics was noted by the end of the second year of training when performing the "push-up" test (up to 34.9 ± 1.1; P (2-3) <0.001). At the same time, their decrease is observed by the end of the third course (up to 30.7 ± 0.6; P (3-4) <0.05).

Significant changes in the values of speed-power characteristics of students in the test "long jump from a place" were not found, although there was an improvement in the values of their results at the end of the second year to 227.4 ± 2.1 cm (compared with the data at the time of admission to the university (224.6 ± 1.2 cm, P> 0.05)). At the same time, they showed a deterioration in the results by the end of the second course (up to 226.5 ± 3.7 cm). The worst result was shown by third-year students (224.4 ± 3.9 cm).

The characteristics of the flexibility value reliably change three times: an increase is observed by the end of the first (from 10.0 ± 0.4 to 12.9 ± 0.8) and second courses (up to 14.9 ± 1.8; P (1–2) <0.05). The decrease in values almost to the previous level at the time of the beginning of study at the university to 10.1 ± 1.6 (P (3–4) <0.05) was again determined at the end of the third year of study, when, according to the curriculum, organized physical education classes are not held.

III. RESULTS AND DISCUSSIONS

The data obtained from monitoring studies determine the vector of the search for ways to improve the physical development and physical fitness of students, and, consequently, their physical health. First of all, a guideline is needed on regular independent physical education classes, and especially when the volume of students' motor activity is significantly reduced.

Professor V.Yu. Lebedinsky proposed defining the concept of "physical health of students" as a person's initially genetically determined motor ability (physical fitness), which undergoes, during his life, marked changes in the process of morphological and functional adaptation (physical development) to changing environmental conditions and life [18].

Monitoring technologies make it possible to assess the students' health status, identify the features of their physical development, the initial level of physical fitness, trace their dynamics and, according to regional standards developed as a result of long-term (since 2007), distribute young men into five levels of its manifestation ("low "," Below average "," average "," above average "," high"). Using monitoring technologies makes it possible to individualize the educational process, finding the most rational ways of prenosological correction of the health status of students. Moreover, monitoring technologies make it possible to distribute students into small social groups according to certain diseases in order to improve their health and increase the efficiency of the organization of the process of physical education. Thus, monitoring allows making informed management decisions on the prevention of diseases of students due to the negative impact of the learning process and the consequences of abuse of bad habits, violation of their work, and rest [19].

Student health is an absolute social value. However, its unsatisfactory condition is associated not only with the deterioration of socio-economic living conditions and unfavorable environmental conditions but also with the underestimation of the role and importance of the health-improving component of physical education in the youth environment as the only non-drug and most effective means of preserving and strengthening it. Therefore, at the Irkutsk National Research Technical University, the Center for Health of Saving Technologies develops and implements innovative technologies aimed at finding comprehensive measures to form a modern model of students' personal development based on a healthy lifestyle and the formation of their motivational focus on their physical improvement. Moreover, teachers of physical education purposefully create conditions for the manifestation of the initiative of the students themselves in the formation of a healthy lifestyle of students.

Teachers use new formats that are interesting for young people to engage students in regular physical education classes at the university. Such new formats include the annual sport and dance festival "Vector of Health," and the Olympiads "The World of Olympic Rings" and the "Olympics Games," as

well as exhibitions and flash mobs "For a Healthy Lifestyle" and other events.

The system of pedagogical influences of the Center is aimed at acquiring the valueological literacy of the young generation. The Center deals with the issues of creating health-saving competence of the student socio-demographic group in the context of its spiritual and moral education, civic responsibility for their health. This focus of the Center is due to the search for conditions for successful career growth of people, solving demographic problems, which is a determining factor in the formation and development of human capital.

The basis of the activities of the faculty of the Department of Physical Culture, aimed at improving student youth, is the installation of students to form their central life position among students "Being healthy is fashionable, stylish, modern."

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