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IMPLEMENTATION OF THE PRINCIPLES OF THE SCIENTIFIC CONCEPT “MEDICINE OF BORDERLINE STATES”, REGARDING DONOSOLOGICAL DIAGNOSIS AND OVERCOMING THE RISKS OF HEALTH DETERIORATION IN STUDENT YOUTH

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Abstract. Implementation of the principles of the scientific concept “Medicine of borderline states” regarding donosological diagnosis and overcoming the risks of health deterioration in student youth. Korobchanskyi V.O., Sarkis-Ivanova V.V., Bohachova O.S., Oliinyk Y.O., Bielecka S.V. Today, the methodological basis of disease prevention among various categories of the population, including students, is an innovative area of medical science and health care practice, namely medicine of borderline conditions. The development of a system of prenosological diagnosis of pathological conditions in young students and their hygienic correction for disease prevention are important both from a scientific and practical point of view. The study was conducted in the conditions of a natural experiment on the basis of three types of educational institutions, at the place of study of representatives of both sexes aged 14 to 23 years, adolescents and young adults. In order to achieve the relevant objectives, the study used the following methods: analytic addressed at the study of educational programs, curricula, schedules, profile and regulatory documents; sanitary-hygienic; psychophysiological; psychological, statistic. Set of risk factors related to the educational process among young people studying in three types of educational institutions – secondary educational institutions, higher educational institution, Professional Agrarian Lyceum was analyzed. It is established that unfavorable living conditions affect donosological mental states of asthenic, hypochondriac and depressive nature.

Реферат. Реалізація принципів наукової концепції «Медицина граничних станів» стосовно донозологічної діагностики і подолання ризиків погіршення здоров'я учнівської молоді. Коробчанський В.О., Саркіс-Іванова В.В., Богачова О.С., Олійник Ю.О., Білецька С.В. На сьогодні методологічною основою профілактики хвороб серед різних категорій населення, включаючи учнівську молодь, є інноваційний напрямок медичної науки і практики охорони здоров'я – медицина граничних станів. Розробка системи донозологічної діагностики передпатологічних станів в учнівської молоді та їх гігієнічної корекції з метою профілактики захворювань є важливими як з наукової, так і практичної точки зору. Дослідження було проведено в умовах натурного експерименту на базі трьох типів освітніх закладів, де навчаються представники обох статей у віці від 14 до 23 років підліткового і юнацького віку. Для досягнення мети дослідження в роботі використані такі методи

дослідження: аналітичний, санітарно-гігієнічний, психофізіологічний, психологічний, статистичний. Було проаналізовано комплекс факторів ризику, пов'язаних з освітнім процесом серед молоді, яка навчається у трьох типах навчальних закладів середньої освіти, вищої освіти, професійного аграрного ліцею. Установлено, що несприятливі умови життєдіяльності відбиваються на донологічних психічних станах астеничного, іпохондричного та депресивного характеру.

The relevance of the topic lies in the implementation of globally recognized preventive activities, in relation to preservation of the health of population which determines the success of the educational process and well-being of further production activities [6, 7]. Based on this, preventive activities to preserve the health of various categories of the population are of great practical importance and is defined as an important state direction in maintaining health and overcoming the risks of general and occupational diseases [12]. In studies of different years, the questionnaire survey identified the main indicators of health disorders of people who were in different conditions, including conditions of quarantine restrictions [5, 16]. A detailed description of the process of emotional disorder, depression and stress in young people has been evaluated by researchers from different countries, it should be noted that the incidence of depression has increased 4 times [17].

Today, the methodological basis of disease prevention in various categories of the population, including students, is an innovative area of medical science and health care practice, namely medicine of borderline states, which studies general patterns of the development of prenosological conditions and transients of their transformations, to prevent somatic and mental diseases of different origin by establishing and minimizing (eliminating) the risks of their occurrence with targeted individual and (or) group correction of the functional state of the body [13]. This progressive medical concept was implemented by a set of scientific investigations on hygienic characteristics and optimization of life of the younger generation: preschool children, schoolchildren, socially maladapted children and adolescents [14], students with disabilities, students of vocational schools [3], students of colleges and technical schools and students of higher educational institutions [10, 15].

The purpose of the study was the prevention of diseases in student youth by establishing and overcoming (minimizing) the risk factors of their life activities based on the determination of objective criteria for prenosological diagnosis of the functional state of the body.

MATERIALS AND METHODS OF RESEARCH

The study was conducted in the conditions of a natural experiment on the basis of three types of educational institutions, at the place of study of representatives of both sexes aged 14 to 23 years of

adolescents and young adults. On the basis of secondary schools of Kharkiv city and Kharkiv region, the study involved 627 high school students of secondary educational institutions (SEI) aged 14 to 17 (296 males and 331 females). Based at Odno-rovivske Professional Agrarian Lyceum (PAL) (Kharkiv region, Zolochiv district) 130 male lyceum students aged 15 to 18 years were under the direct dynamic supervision. On the basis of higher education institution (HEI) Kharkiv National Medical University 827 students aged 17 to 23 years (308 males and 519 females) were surveyed. In order to achieve the relevant objectives, the study used the following methods: analytic one, aimed at the study of educational programs, curricula, schedules, profile and regulatory documents, as well as establishing important professional features and qualities; sanitary-hygienic – aimed to measure indicators of living conditions [8]; psychophysiological – to determine the functional state of the CNS and the level of professionally important physiological functions [9]; psychological – to evaluate personal characteristics and professionally important psychological qualities [13]. The study meets modern requirements of moral and ethical standards and was conducted in accordance with the principles bioethics set out in the Welsh Declaration of Helsinki – “Ethical principles of participatory medical research People” and the “Universal Declaration on Bioethics and Human Rights” (UNESCO). The study analyzed the impersonal data of respondents under the Law of Ukraine “On Personal Data Protection”. According to the conclusion of the expert commission of Kharkiv National Medical University, the research methods described in the publication were applied in compliance with human rights in accordance with current legislation in Ukraine, they do not violate ethical norms in science and standards of biomedical research. The analysis of the obtained results was carried out by using traditional statistical processing methods [1] using statistical analysis applications Statistical processing of materials was performed using programs “Statsoft Statistica 8.0” (STA862D175437Q).

RESULTS AND DISCUSSION

Investigation of the conditions of life of representatives of three groups of student youth aimed to determine the relevant risk factors regarding the probable deterioration of health.

Regarding the life of senior HEI students, the study showed a motor activity ($56.49 \pm 6.94\%$, $p < 0.05$), which is due to the availability of modern means of physical improvement for urban youth. However, ($27.87 \pm 6.28\%$, $p < 0.05$) of students under investigation did not comply with requirements of the rational day regimen due to going to bed lately, reduced sleep duration and getting up late, a significant number of respondents estimated psychological microclimate of their environment as unsatisfactory ($9.86 \pm 4.47\%$, $p < 0.05$), a certain number of respondents described their nutrition as "above average" ($22.11 \pm 5.81\%$, $p < 0.05$). In addition, $8.5 \pm 3.51\%$ of the examined senior students did not follow the rules of a healthy lifestyle, being prone to drinking alcoholic beverages and smoking. In relation to the daily living activities of PAL students, the study established that the vast majority of lyceum students ($85.71 \pm 5.40\%$ or more respondents, $p < 0.001$) enjoyed favorable psychological microclimate in the team and are in compliance with the rules of personal hygiene and a healthy lifestyle ($86.21 \pm 6.40\%$, $p < 0.001$). However, the obvious factor that can significantly complicate daily life of lyceum students was rather low motor activity during all years of study ($68.97 \pm 8.59\%$, $p < 0.01$). It is also noted that with a certain stability of the indicators of psychological microclimate ($p < 0.001$), during training (from the 1st to the 3rd year) there was a gradual decrease in motor activity ($p < 0.01$). Daily life activity of HEI students occurred mainly under the conditions of favorable psychological microclimate ($93.52 \pm 3.98\%$ of respondents evaluated it as optimal, $p < 0.01$), strict adherence to personal hygiene requirements ($77.91 \pm 4.52\%$ of respondents, $p < 0.05$). At the same time, students are influenced by the complex of unfavorable regime-organizational factors associated with a significant remoteness of educational premises, asynchronous and excessive duration of the school day, lack of free time and time for sleep, leading to a decrease in motor activity ($55.84 \pm 4.34\%$), a violation of labor and recreation regime ($38.95 \pm 3.02\%$, $p < 0.05$), non-compliance with rational nutrition requirements ($64.93 \pm 4.11\%$, $p < 0.05$). In addition, $22.07 \pm 3.64\%$ of students were found to be prone to harmful habits.

Regarding daily life activities of the student youth in the conditions of the Covid19 pandemic, the study showed its negative impact on the lifestyle of students. The most frequent complaints were disorders of sleep regime, headaches, changes in the visual organs, which might be triggered, firstly, by the restructuring of the day regime, a non-rational organization of workplace and time, physical inactivity and information overload as a whole.

Regarding the state of health of senior SEI pupils, the study found that more than 70% of senior pupils could be described as healthy persons ($44.81 \pm 2.22\%$ – health group I, $26.57 \pm 1.97\%$ – health group II). Health group III (patients) included $26.94 \pm 1.98\%$ individuals. Up to 2% of the surveyed belonged to persons with disabilities. The most common diseases among senior SEI pupils were acute and chronic bronchitis, bronchopneumonia ($16.80 \pm 1.67\%$) and allergic diseases ($16.00 \pm 1.64\%$).

Regarding the health of PAL students, the study established a significant number of subjects with chronic diseases, which increased under the influence of unfavorable factors of the training and production environment. A significant number of lyceum students belonged to health group III (patients in compensation stage), which accounted for $37.50 \pm 7.65\%$ in the first year and remained unchanged during the period of study ($p > 0.05$), and $2.50 \pm 2.47\%$ – group IV (congenital malformations, deformation and chromosomal anomaly). In the structure of chronic morbidity, the diseases of digestion ($13.74 \pm 5.44\%$), eye and accessory apparatus ($12.21 \pm 5.18\%$), blood circulation disease ($6.87 \pm 3.99\%$) were dominant. The incidence of chronic diseases significantly increased throughout the three-year training period (from $47.5 \pm 7.89\%$ to $74.47 \pm 6.36\%$, $p < 0.05$), especially the following nosological forms: diseases of eye and accessory apparatus, blood circulation system, urogenital system, respiratory system, skin and subcutaneous cellular tissue, skeletal-muscular system and connective tissue.

Regarding the state of health of HEI students, the study established that the general overloads exerted on students by concomitant effect of the special factors of the educational process and adverse factors of the educational environment (overproduction of the thermoregulation system as a consequence of violations of the air-heat regime) lead to an undesirable but clearly expressed trends: in the process of learning a decrease in the number of people in health group I from $47.00 \pm 7.80\%$ to $35 \pm 7.65\%$ ($p < 0.05$), due to a significant increase in the number of people belonging to health groups II (from $22 \pm 1.97\%$ to $26 \pm 2.93\%$) and III (from $31.00 \pm 6.65\%$ to $39 \pm 7.60\%$), ($p < 0.01$).

Indicators of prenosophical mental state, along with the indicators of the psychophysiological state of representatives of certain groups of student youth, belong to the criteria of prenosophical diagnosis of risk of development of pathological states.

The state of mental health of senior SEI pupils was assessed on the basis of a study of the prevalence of prenosophical mental states. Senior pupils with borderline mental deviations amounted for $50.57 \pm 7.00\%$ of the number of surveyed, indicating a significant

distribution of prenosological conditions of asthenic (14.94±4.93%), hypochondric (25.29±6.02%) and depressive (36.78±6.78%) features which characterizes half of the studied schoolchildren. Only the frequency of the states of the borderline hypochondria syndrome significantly decreased in pupils of the 11th

grade ($p < 0.05$), which obviously may be associated with a more responsible and critical attitude of graduates to their health. Psychophysiological characteristics of the functional state of SEI senior pupils is given in Table 1.

Table 1

Characteristics of mental health of adolescents studying in 9-11 grades of Kharkiv secondary school (P%±m%; n=151)

Period of study	Without deviations	With deviations	Asthenic syndrome		Depression syndrome	Hypochondria syndrome
Grade 9	48.28±6.56	51.72±6.56	17.24±4.96		34.48±6.24	27.59±5.87
Grade 10	48.28±7.80	51.72±7.80	20.69±6.33		31.03±7.22	34.48±7.42
Grade 11	51.72±6.93	48.28±6.93	6.89±3.51		44.83±6.89	13.79±4.78
p _{1/2}	> 0.05	> 0.05	> 0.05		> 0.05	> 0.05
p _{2/3}	> 0.05	> 0.05	> 0.05		> 0.05	< 0.05
p _{1/3}	> 0.05	> 0.05	> 0.05		> 0.05	> 0.05

Notes: * – p_{1/2} – reliability of differences between 9th and 10th grades; p_{2/3} – reliability of differences between 10th and 11th grades; p_{1/3} – reliability of differences between 9th and 11th grades.

Assessment of mental performance of senior SEI pupils showed that these indicators of cognitive activity were characterized by a certain stability of the accuracy coefficient for 9th-11th grades (from 0.871±0.01 to 0.895±0.01), an increase in mental performance (from 158.017±3.26 to 201.671±7.07), stability and volume of attention for 9th to 11th grade (from 36.899±2.78 to 84.89±12.18) ($p < 0.05$ and $p < 0.01$) and attention concentration coefficient (up to 14.566±1.28) ($p < 0.01$), which again decreased to 12.84±1.44 ($p < 0.01$) in the 11th grade. The lack of functional stability of senior pupils was identified by a significant decrease in the mental performance of senior pupils during the academic week ($p < 0.001$). Evaluation of indicators of short-term memory of senior pupils showed that the percentage of correct responses in 9th and 10th grades decreased to 5 and 6 digital signs, respectively, and further increase in the indicators of up to 8 digital signs, with minimal values of 82.12±2.57% and 92.5±1.71% respectively. The percentage of correct responses decreased to the sixth and seventh digital signs with subsequent insignificant increase. In addition, the research identified that senior pupils had an effective way to memorize and reproduce information. Besides, 50.0±5.21% of PAL students were found to have a deviation in the mental state of prenosological nature, which extended with the term of study, the highest one was in the first year – 59.09±10.48% of students,

51.72±9.28% – in the second and 62.2±7.57% – in the third year students ($p < 0.05$). The most widespread prenosological state was a predictor of depression (up to 31.8±9.93% of the number of the surveyed), hypochondria was the least widespread (up to 10.80±4.85%). During the studies, significant changes in the structure of prenosological mental states were not observed ($p > 0.05$). Psychophysiological characteristics of the functional state of PAL adolescents indicated the effectiveness of the existing system of study at PAL. This feature was associated with a significant improvement in the level of implementation of the professionally significant function of representatives training in agrarian specialties, namely equability of the nervous system, which at the beginning of the study period (the beginning of the 1st year) was in accordance with the physiological norm in 35.29±8.19% of the studied persons, and at the end of the term of training (end of the 3rd year) showed a physiological norm in 45.95±8.19% of lyceum graduates ($p < 0.05$). According to this indicator of the nervous system, the end of the second year of study was the most critical when the number of persons with belated reaction was 58.62±9.15% ($p < 0.05$) from the number of examined lyceum students, which objectively indicated the domination of inhibition process, as a consequence and manifestation of significant fatigue.



The general trend of the mental performance of PAL students was its gradual growth with the term of study against physiologically determined fatigue which is the most severe in the 2nd and 3rd year. The coefficient of mental performance increased from 686.35±28.61 standard units up to 731.14±21.40 ($p>0.05$) from the 1st to 3rd year, the rate of stability of attention from 37.89±7.97 standard units to 53.29±7.49 standard units, $p>0.05$ followed by a sharp drop to 35.12±3.99 standard units ($p<0.05$), the

coefficient of accuracy remained practically unchanged ($p>0.05$). Statistically significant reduction of such indicators as the accuracy coefficient and the coefficient of stability of attention in the 2nd year of study ($p<0.05$), and a significant reduction in the rate of stability of attention in the 3rd year ($p<0.05$) allowed to attribute this time to the periods of risk, requiring the introduction of psychohygienic measures to correct the regime of the day and the adaptive process as a whole (Table 2).

Table 2

Dynamics of mental performance of PAL students during study

Indicator	1 st year of study beginning of year end of year	2 nd year of study beginning of year end of year	3 rd year of study beginning of year end of year
Accuracy coefficient	<u>0.950±0.006</u> 0.960±0.006	<u>0.970±0.004</u> 0.950±0.004	<u>0.960±0.005</u> 0.950±0.008
p	>0.05	<0.001	>0.05
Mental performance coefficient	<u>686.35±28.61</u> 749.83±31.93	<u>703.5±24.93</u> 676.73±11.16	<u>731.14±21.40</u> 669.04±24.68
p	>0.05	>0.05	>0.05
Attention stability coefficient	<u>37.89±7.97</u> 41.90±9.28	<u>45.38±9.08</u> 24.20±2.11	<u>53.29±7.49</u> 35.12±3.99
p	>0.05	<0.05	<0.05

Notes. * – p – reliability of differences.

Evaluation of the prevalence of prenosological mental states among HEI students showed that a large number of students ($p<0.001$) had prenosological states that can transform into asthenic, depressive or hypochondric disorders under certain conditions. In modern system of education, the percentage of persons with the above-mentioned prenosological states was 42.95±2.27%. Depressive manifestations (40.38±2.77%) prevailed in the structure of prenosological mental states. The second place was occupied by precursors to asthenia (11.21±1.78%). A small number of students were found to have hypochondric manifestations (7.05±1.44%).

Psycho-physiological assessment of the functional state of HEI students found an improvement of their functional state from the first to last year of training. Statistically significant improvement was typical both for indicators of the basic properties of the nervous system (balance, strength, motor activities $p<0.05-0.001$) and leading psychophysiological functions that provide cognitive activity of students, namely different measured features of attention and memory. At the same time, the study showed that the functional state of the CNS of HEI students was distinguished by high stability during the “normative”

(everyday educational load). All this indicates a sustainable functional state of students, which under normal conditions is characterized by stability and high levels of implementation (Table 3).

Under conditions of natural loading test (increased mental and psycho-emotional loads during the preparation to exams, credits, module control), aimed at identifying the CNS adaptation reserves, first year students were shown to have a variety of changes in the leading indicators of the functional state ($p<0.01-0.001$): a significant decrease in the coefficient of accuracy (up to 0.810±0.01 standard units) and an increase in the coefficient of attention stability (up to 66.00±2.85 standard units). This phenomenon can be estimated as immaturity of physiological mechanisms of maintaining the stable state of the body. This phenomenon was typical for students of the first three years of training. Senior students had another result in loading test. Statistically significant discrepancies between the indicator of the functional state of the central nervous system before and after the load were not observed ($p>0.05$). This indicates the actualization of the functional capabilities of students which develops as a result of studying at HEIs.

Dynamics of mental performance in HEI students in the conditions of ordinary educational load ($M \pm m$, $n=200$, standard units)

Indicator	Indicator value (standard unit)		p
	at the beginning of lecture	at the end of lecture	
Students of medical higher educational institution			
Accuracy	0.846 \pm 0.018	0.869 \pm 0.01	>0.05
Performance	195.8 \pm 5.8	199.3 \pm 4.8	
Attention stability	55.13 \pm 5.56	48.37 \pm 8.49	

The obtained results showed that female subjects had better rates of accuracy coefficient, both in conditions of ordinary educational load (0.869 \pm 0.01 standard units), and in increased psychoemotional load (0.835 \pm 0.01 standard units), whereas males had significantly lower coefficient of accuracy indicators in the same conditions (0.803 \pm 0.03 standard units and 815 \pm 0.02 standard units, respectively, $p < 0.01$). The result of a comparative study suggests that females demonstrated better results according to individual indicators of mental performance than males, but this is not a sign of the worst functional state of the central nervous system, which is a multidimensional process in which there are complex transformations in the scenarios of complementarity and compensation of individual functions providing cognitive activity.

It is well known that risk factors for the life activities of young students directly affect the state of health [2, 4], which is fully confirmed by the results of these studies. The used methodology of prenosological diagnosis is aimed at the world-recognized priority area of health care, namely disease prevention [11, 13]. The obtained results concerning the state of health of young students, prepathological (prenosological) mental disorders, the quality of cognitive activity correspond to modern concepts of the world paradigm of health care [7, 17], but are the methodological basis for its improvement.

CONCLUSIONS

1. The identified risk factors for the conditions of life activities of student youth directly affect the state of health in terms of a decrease in the body's resistance and an increase in the risk of acute respiratory illnesses; a change in health status according to the definition of belonging to the relevant health group; a prevalence of chronic diseases (acute and chronic bronchitis, bronchopneumonia (16.80 \pm 1.67%) and allergic diseases (16.0 \pm 1.64%), significant increase in chronic pathology (from 47.5 \pm 7.89% to

74.47 \pm 6.36%, $p < 0.05$) primarily according to the following nosological forms: diseases of the eye and accessory apparatus, diseases of the circulatory system, diseases of the genitourinary system, respiratory diseases, diseases of the skin and subcutaneous tissue, diseases of the musculoskeletal system and connective tissue).

2. According to the implementation of the principles of the scientific concept "Medicine of borderline states" criteria for prenosological diagnosis to objectively assess the health of young students studying at different educational institutions (for example, SEI, PAL, HEI) are indicators of deviation in mental state of prenosological type which made up 50.57 \pm 7.00%, 50.0 \pm 5.21% and 42.95 \pm 2.27% of the number of examined persons from all educational institutions respectively (of asthenic, hypochondric and depressive nature) and indicators of the quality of cognitive activity (balance, strength and lability of nervous processes, the coefficient of mental performance, the coefficient of stability of attention, the coefficient of accuracy, the volume of short-term memory). Each of the above qualitative indicators of prenosological diagnosis of the functional state of the organism has a quantitative characteristic.

Contributors:

Korobchanskyi V.O. – conceptualization, data curation, project administration supervision;

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Oliinyk Y.O. – methodology, investigation;

Bielecka S.V. – validation, writing – review & editin.

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