MEDICAL AND BIOLOGICAL ASPECTS OF THE ASSESSMENT OF THE RISK FACTORS

UDC 613.6 : 616 – 01 / – 099

MODELING OF HEALTH RISK FACTORS AFFECTING THE SPORTSMEN AND YOUNG MALES WHO ARE NOT INVOLVED IN SPORTS ACTIVITIES

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The purpose of this study was to develop and implement the risk assessment method for detection of health deterioration in sports high school students. To evaluate the health status of the students, the questionnaires and the method for express physical health evaluation by G.L. Apanasenko was used. Sampling size comprised 250 young males students from 2–3 courses of various faculties. To identify the correlation between the physical health level and the indicators of psychosomatic syndromes, the correlation analysis has been used. It was established, that the safety level of the somatic health belonged to more than a halve of the students engaged in sport and to a third part of the students, that are not engaged in sport. The critical level of the physical status was registered with equal frequency in both groups. The low physical health level was detected 3.7 times frequently in the students who were not engaged in sports activities in comparison to the sportsmen. Basing on the data, obtained by the "decision tree" method, the models of health deteriorations' risk in young males, engaged and not engaged in sport, have been built. The application of these models allow performing preclinical diagnosis and health monitoring without special equipment. The advantage of the offered method is its speed and the possibility to survey large numbers of contingents of various ages.

Key words: *students of sports high school, young males involved and not involved in sports, model of health deterioration risk, questionnaires, a method of risk assessment of health problems, "decision tree" method, preclinical diagnosis and health monitoring.*

Background. The analysis and assessment of the environmentally-determined health risks are among the fastest developing research fields of immediate interest [9, 11].

Students are generally considered to be at-risk in terms of their health [7, 19, 21]. Information overload, exam-related stress, irregular nutrition, lack of physical activity, poor study/life balance, and bad habits present health risks, foster diseases during college, and promote the development of psychosomatic disorders [5,13, 15, 17, 20].

In the past 10 years alone, the disease rate among students has gone up by 35%. According to N. Agadzhanyan, the number of healthy students over their time in college decreases on average by 25.9%, and the number of chronically ill students increases by 20% [7]. According to S. Lopatin [4], by the end of college, every other student has a chronic disease, and the number of health students does not exceed 10-15%.

The adjustment period lasts on average two years, including first and second year in college; here, the probability of desadaptation conditions is rather high [18, 21\. The students of sports majors usually have more troubles with college adjustment. The reason for that is the fact that their college studies involve not only a heavy mental workload, but also psychoemotional and physical overload.

On the other hand, regular physical activities have a positive influence on the adaptive capabilities and physical development [12]. However there are areas that require further studies including the state and specific nature of psychosomatic health of physical education students

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[1, 5], the factors that determine the state of health during professional training [6, 16], prevention and adjustment of mal-adaptation in students [5 18], and health monitoring [3, 13].

Health screening today involves a lot of functional tests that are time-consuming and technologically cumbersome. And test results do not always agree with the health self-assessment made by a patient. For this reason, development and implementation of health self-assessment and risk-identification methods for students are an essential task.

Mathematical modeling is a prospective area of health risk assessment and management because it helps save time and money [8].

In this way, negative trends in general health and the lack of research papers on student health assessment and risk detection point to the importance of this study. Development and implementation of the methods of individual health risk assessment in students promote timely prevention and adjustment of health conditions.

Materials and Methods. The study was conducted by the Department of Anatomy, Physiology, Sports Medicine and Hygiene at the Siberian State University of Physical Education and Sport. The survey included 250 2nd and 3rd year students of sports, liberal arts, tourism, recreation and rehabilitation departments involved and not involved in sports. Qualifications of athletes: 1 level - 44.6%, the master of sports candidates – 37.6%, and the masters of sports - 17.8%. Evaluation of physical health was conducted in 100 young men (65 athletes and 35 young men who are not involved in sports).

The method of quantitative health assessment developed at the Research Center for Child and Teenage Health Protection at the Russian Academy of Medical Sciences was used to assess psychosomatic health [2]. The questionnaire “Health Assessment by Functional Systems” included six blocks of questions aimed to detect mental disorders, and eight blocks of questions aimed to detect somatic disorders (otorhinolaryngological, gastrointestinal defeat syndrome, cardiovascular, vegetative-vascular). The questionnaire had additional four sections on the anemic, allergic, infectious and autoimmune syndromes. Evaluation of each of the studied syndrome was conducted with the use of two parameters: display frequency (no – 0 points, rarely – 1, frequently - 2, always - 3), the level of expression (no - 0, low - 1, moderate - 2, high - 3). Based on these data, integral index was calculated (the sum of points on frequency and strength), or measure of pain that is characteristic of a problem in a particular symptom block.

In the assessment of physical fitness, a methodology by GL Apanasenko [1] was used. It included indicators characterizing physical development (Quetelet index, index of life, and power index); the state of the cardiovascular system (heart rate, blood pressure, Robinson index - an indicator of double work); the recovery of heart rate after dosed physical load. With this technique, it is possible to get a fairly complete and objective picture of the physical condition and to predict the risk of a disease.

The analysis of the relationship between the state of physical health as described by GL Apanasenko (dependent variable) and the indicators of psychosomatic syndromes (independent variables) was performed using correlation analysis. The method of "decision tree" was used to construct models of the risk of health disorders using Data Mining technology, Deductor Studio Academic program (version 5.2) [10].

Results and Discussion. The survey results indicated that the most frequent syndromes among the students of sports majors were of mental nature: asthenic, hysteria-like, psychoasthenic, neurotic, and pathocharacterological, - rather than of somatic nature ($p < 0,05$). Hysteria-like and asthenic syndromes were the most common (11.5% and 11.3%, respectively). Common somatic syndromes included otorhinolaryngological, vegetative-vascular, and cardiovascular syndromes (6.3%, 5.9% and 5.5%, respectively).

The study found that male athletes compared to non-athletes rarely registered psychiatric syndromes ($p<0.05$). Male athletes frequently observed psychoasthenic syndrome (7.0%), in non-athletes, and hysteria-like asthenic syndrome (14.0% and 14.3% respectively). Young men not involved in sports, compared to athletes, showed a higher incidence of signs of the vegetative-vascular (19.8% and 10.0%), otorhinolaryngological (12.5% and 6.9%), anemic (12.2% and 7.2%), and cardiovascular (10.3% and 5.3%) syndromes ($p < 0,05$).

Physical health evaluation by GL Apanasenko showed that among young men involved in sports, 57.0% had good (4 or less points) and above average (5-9 points); 33.8% - average (10-13 points); 9.2% of students - below average (14-16 points) and bad (17-21 points) health. Among those not involved in sports, good and above

average health was registered in 34.3% of the students, average level - in 31.4%, below the average and bad health was detected in 34.3% of the students.

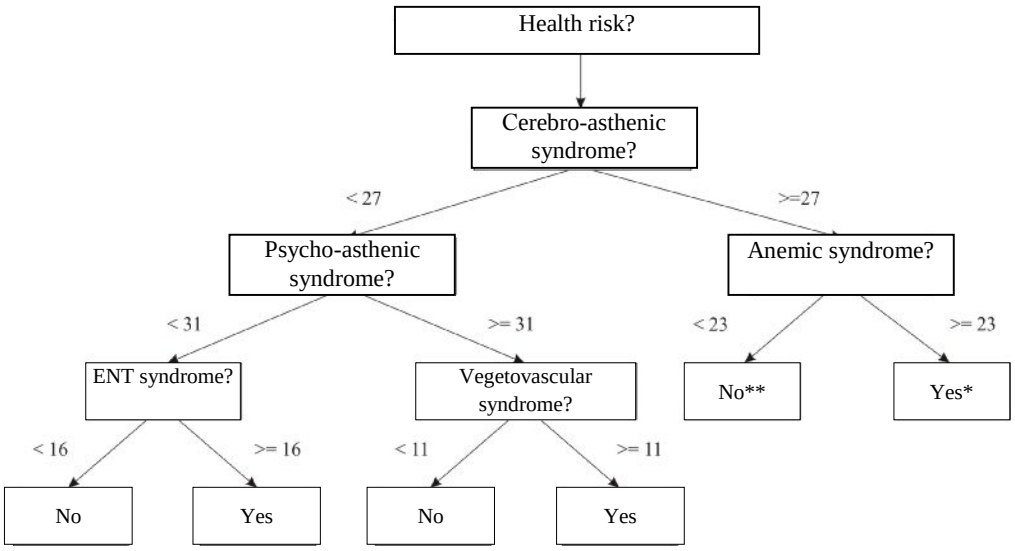
According to GL Apanasenko [1], a safe level of somatic health guaranteeing the absence of diseases is found only in people with high levels of physical condition. An average physical condition can be regarded as critical. Further reduction in the functional state is already leading to clinical illness with appropriate symptoms.

Correlation analysis revealed a connection between the level of physical health of youth athletes with signs of cerebroasthenic syndrome (r = 0,81), and the indicators of anemic (r = 0,65), otorhinolaryngological (r = 0,63), and psychoasthenic (r = 0,57) syndromes.

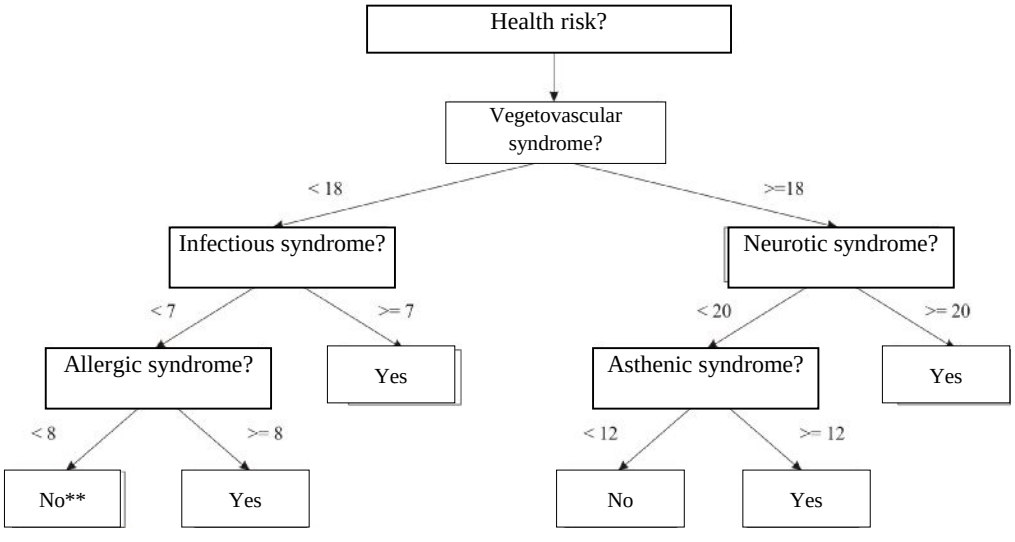
The respondents not involved in sports revealed a strong correlation between the level of physical health and the indicators of vegetative-vascular syndrome (r = 0,72), and an average connection – with the indicators of neurotic (r = 0,64), infection (r = 0,61) allergic (r = 0,58), and asthenic syndrome (r = 0,52).

These relationships between the physical health indicators and the psychosomatic syndromes indicators in students involved and not involved in sports, were used to construct the following health risk models (Fig. 1 and 2).

The six rules below established with the help of decision tree determine the values at which individual syndromes form or a health risk does not form in athletes (Table 1).



a



b

Figure. Health risk model in young men: *a* – atheletes; *b* – in non-athletes.
Notes: * – health risk; ** – zero health risk

Table 1

The rules that form health risk in males involved in sports

Indicator	Value (points)	Consequence	Support %	Significance %
Cerebro-asthenic Anemic	>= 27 >= 23	yes	38.7	100.0
Cerebro-asthenic Anemic	>= 27 < 23	no	19.3	100.0
Cerebro-asthenic Psychoasthenic Vegeto-vascular	< 27 >= 31 >= 11	yes	23.5	91.7
Cerebro-asthenic Psychoasthenic ENT	< 27 < 31 >= 16	yes	8.2	100.0
Cerebro-asthenic Psychoasthenic ENT	< 27 < 31 < 16	no	5.8	84.8
Cerebro-asthenic Psychoasthenic Vegeto-vascular	< 27 >= 31 < 11	no	4.5	82.0

Table 2

Significance of syndromes in a health risk model for males involved in sports

Syndrome	Significance, %
Cerebro-asthenic	61.1
Anemic	17.7
Psycho-asthenic	13.4
Vegeto-vascular	5.5
ENT	2.3

The significance of syndromes in a health risk model for athletes is presented in Table 2 below. Physical health indicator was selected as the target attribute.

93.1% of syndromes were categorized correctly which indicates a rather high quality of the model. Below is the model interpretation. Athletes are prone to health risk under the following combination of syndrome intensity:

1. If the indicator of cerebroasthenic syndrome is 27 points or greater, and the indicator of anemia is 23 points or greater.

2. If the value of cerebro-asthenic syndrome is less than 27 points, but the indicators of psycho-asthenic and vegetative-vascular syndromes are greater than 31 and 11 points respectively.

3. If the indicators of cerebro-asthenic and psycho-asthenic syndromes are less than 27 and 31 points respectively, and the value of ENT syndrome - 16 points or greater.

A health risk model for males not involved in sports helped establish six rules that describe the combinations of indicators of the syndromes which present a health risk (Table 3).

Significance of the syndromes in a health risk model for males not involved in sports is presented in Table 4 below. Physical health indicator was selected as target attribute.

Table 3

The rules that form health risk in males not involved in sports

Indicator	Value (points)	Consequence	Support %	Significance %
Vegeto-vascular Nuerotic	>= 18 >= 20	yes	29.5	100.0
Vegeto-vascular Infectious	< 18 >= 7	yes	28.8	100.0
Vegeto-vascular Neurotic Asthenic	>= 18 < 20 >= 12	yes	24.2	100.0
Vegeto-vascular Infectious allergic	< 18 < 7 < 8	No	8.2	95.4

Vegeto-vascular Infectious allergic	< 18 < 7 >= 8	Yes	5.8	89.2
Vegeto-vascular Neurotic Asthenic	>= 18 < 20 < 12	no	4.5	90.1

Table 4

Significance of syndromes in a health risk model for males not involved in sports

Syndrome	Significance %
Vegeto-vascular	50,2
Neurotic	22,8
Infectious	14,6
Asthenic	7,3
Allergic	5,1

95.8% of syndromes were categorized correctly which indicates a rather higher quality of the model.

The above model can be interpreted as follows. Males not involved in sports are prone to health risk under the following conditions:

1. If the indicator of vegetative-vascular syndrome is greater than 18 points, and the indicator of neurotic syndrome is 20 points or greater.

2. If the indicator of vegetative-vascular syndrome is greater than 18 points, the value of neurotic syndrome is less than 20 points, and the value of asthenic syndrome is greater than 12 points.

3. If the indicator of vegetative-vascular syndrome is greater than 18 points, and the indicator of infectious syndrome is 7 or greater.

4. If the indicator of vegetative-vascular syndrome is greater than 18 points, infectious syndrome - lower than 7, and allergic syndrome - greater than 8 points.

The students which are not involved in sports are not prone to health risk under the following combination of syndromes:

1. If the value of vegetative-vascular syndrome is 18 points or greater, the indicators of neurotic and asthenic syndromes are greater than 20 and 12 points respectively.

2. If the value of vegetative-vascular syndrome is greater than 18 points, the values of infectious and allergic syndromes are greater than 7 and 8 points respectively.

Conclusion. Thus, express questioning revealed that the students of sports majors had a higher incidence of mental syndromes (asthenic, psycho-asthenic, and neurotic). The incidence of mental syndromes in young men involved in sports was lower than in the students not involved in sports. The young men not involved in sports, as compared with the students involved in sports, had a higher incidence of the signs of vegetative-vascular, otorhinolaryngology, anemic and cardiovascular syndromes.

A physical health evaluation conducted according to the method by GL Apanasenko showed that more than half of the young people involved in sports, and a third of the students not involved in sports had good physical health. A critical level of physical health was detected with a similar frequency in both groups of students. Poor physical health was detected by 3.7 times more often in young men not involved in sports.

The developed health risk assessment models allow for a preclinical diagnosis, health monitoring, and risk identification without the use of special medical equipment. The advantage of the proposed questionnaire method is its speed and the ability to survey large numbers of respondents of various age groups.

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