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Estimation of Adaptable Possibilities of Medical Students Based on Climatic Factors.

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ABSTRACT

The paper presents a methodology for evaluation and possible prediction of the functional state of the organism using adaptive capacity index, which allows us to recognize the pre-pathology, carry out preventive and medical-diagnostic measures. We have defined the control parameters of the equation, which takes into account the daily and annual cyclical dynamics of meteorological factors.

Keywords: adaptation, meteorological factors, cardiovascular system, modeling.

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INTRODUCTION

Meteorological factors can cause a variety of responses of the human body, including exacerbation of somatic pathology.

Several studies have established a correlation between meteorological factors and the functioning of the cardiovascular system, including the heart rate variability [1, 3, 4]. This can be explained by the fact that the cardiovascular system reacts before the other systems of the body to changing weather factors, and this response is quite dynamic and allows evaluating the body's adaptation to the changing conditions [6, 9]. Human adaptation to environmental change is complemented by a change in human social functions, his adjustment to the changing environmental conditions. These changes can achieve complete adaptation when the body reacts to external weather conditions without losing social adaptation, while maintaining increased capacity for work [5, 8].

At the same time, the formation of an answer to the peak of adaptive abilities, and sometimes beyond adaptation. Disruption of adaptation or maladjustment are possible in persons who had initially low levels of adaptation processes in the body. This prolonged exposure to adverse factors lead to aggravation disadaptation processes, reduced concentration and reduced efficiency [2, 7].

The study of adaptation options among students is important. This group consists of young healthy people. The study of adaptation processes in these entities will allow establishing the criteria for adaptation border states and those states that are already beyond the adaptive capacity.

Identification of the border states will allow to establish prenosological state and establish ways to increase adaptation of the organism to external factors.

Evaluation of the functional state of an organism is very important in students, making it possible to reduce the adverse factors on the organism, increasing disability and improve mental performance. Correction of adaptation changes perpetuate the vicious chain of "tension - fatigue - overvoltage - maladjustment".

The extent of the revealed deviations from the standard values of indicators suggests a degree of adaptive capacity changes. Determination of the reference point of normal adaptive capacity values is important in this process. When the results are outside the boundary limits it is necessary to take action aimed at correcting the changes and save the adaptive characteristics at an acceptable level to maintain the high efficiency of the whole organism.

It is necessary to analyze the dynamics of the process of adaptation, which will allow making adjustments even before the first signs of maladjustment.

The aim of the study was to investigate the adaptive capacities of medical students based on cardiovascular parameters in relation to meteorological factors.

MATERIALS AND METHODS

The object of the study are medical students 5 and 6 courses including 80 people. They carried out regular surveys of the functional state of the cardiovascular system during the last 2 years. Each case contains several parameters: heart rate, systolic and diastolic blood pressure, and time of day of measurement, as well as derived indicators - Kerdo index, blood pressure range and adaptation index. Database of weather factors during the same period was established for research purposes.

Linking of meteorological factors and clinical assessment conducted by date of observation, including the previous five days prior to the survey.

RESULTS AND DISCUSSION

The best in our opinion is the development of customized models of adaptive capacity, taking into account the seasonal weather features.

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For this purpose we have been allocated 12 weather factors, which most frequently observed significant correlations with the parameters of the cardiovascular system and is the most affordable: temperature, atmospheric pressure and wind strength and direction on the day of the study and the previous day, their day and night levels.

Individual models were obtained by using some meteorological factors for calculating the reference levels of the following parameters: systolic and diastolic blood pressure, heart rate, Kerdo index, adaptive capacity. If there is data on the parameters of the cardiovascular system (blood pressure, heart rate) and meteorological factors for the 30 days prior to the day of the study, it is possible to make prediction for 33-38 hours. Models are self-learning with the imperative of creating a 30-day observation base.

As an example, we have constructed and presented graphs of the dynamics of systolic blood pressure (SBP), which reflects the fluctuations in the control and actual performance in normal conditions (Figure 1) and the compensated functional abnormalities (Figure 2) within 30 days of observation. In the first case, the average value and the interval width is as close to the normal physiological range, fluctuations unexpressed. Going beyond the "corridor" of normative benchmarks indicate pathological abnormalities of the body, maladjustment phenomena.

In the area of graphs showing the forecast for 33-37 days, there are apparent differences between the levels of actual and simulated values of: excess of the actual indicator above the predicted level (day 33), or a sharp decline (day 35). Apparently, this is because in our model, we consider only meteorological factors and does not take into account the possible psycho-emotional stress, exercise, medication, and other factors faced by the student and which affect the cardiovascular system. However, it is of interest to us is the ability to predict the nature of the oscillations regardless of the level of these changes (such as raising or lowering of systolic blood pressure).

Fig 1: the dynamics of actual and obtained by the model SAD values in normal conditions in N. student

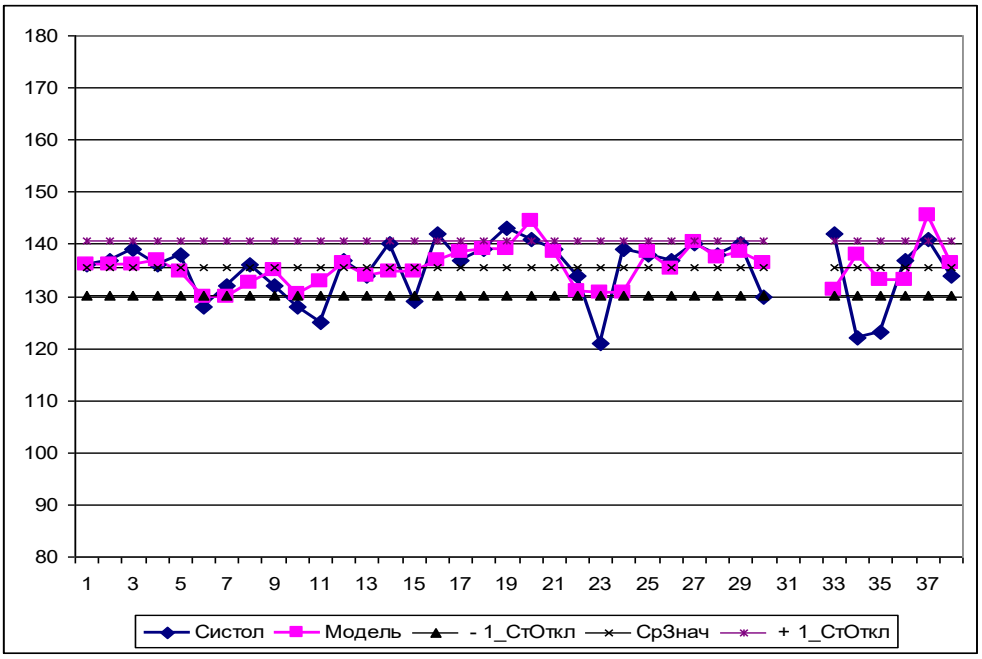

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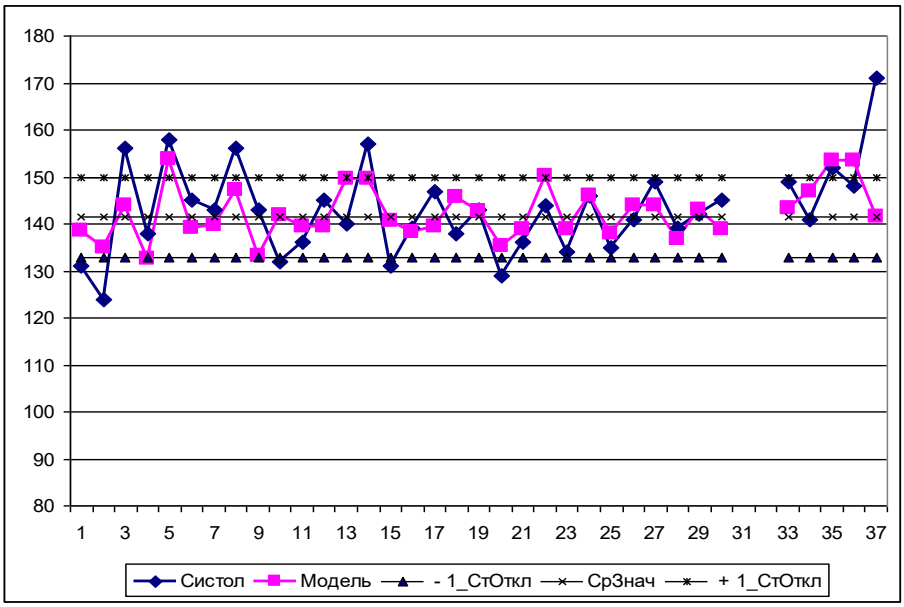
Fig 2: the dynamics of actual and obtained by the model SAD values in a compensated functional abnormalities in N. student



We have developed a model of adaptive capacity for the age group 20-25 years. The formula for calculating this indicator included heart rate, systolic and diastolic blood pressure.

AC (points) = 0.008 (heart rate) + 0.001 (systolic blood pressure) + 0.005 (diastolic blood pressure) + 0.01 (Age)

These indicators reflect the functioning of the organism more objectively; it is advisable to use them in the process of forecasting. The higher the index of adaptive capacity, the lower the capacity of the organism, ie, a measure "adaptation loss." The reference point is the value in 2.355 points.

In the graphs, reflecting the normal functioning of the body (Figure 4), the AC value is closer to normal (below 3), in case of functional disturbances AC increases to 3.5 (Figure 3), which confirms the expected state.

Figure 3: The dynamics of actual and obtained by AC model values in a compensated functional abnormalities of the student A.

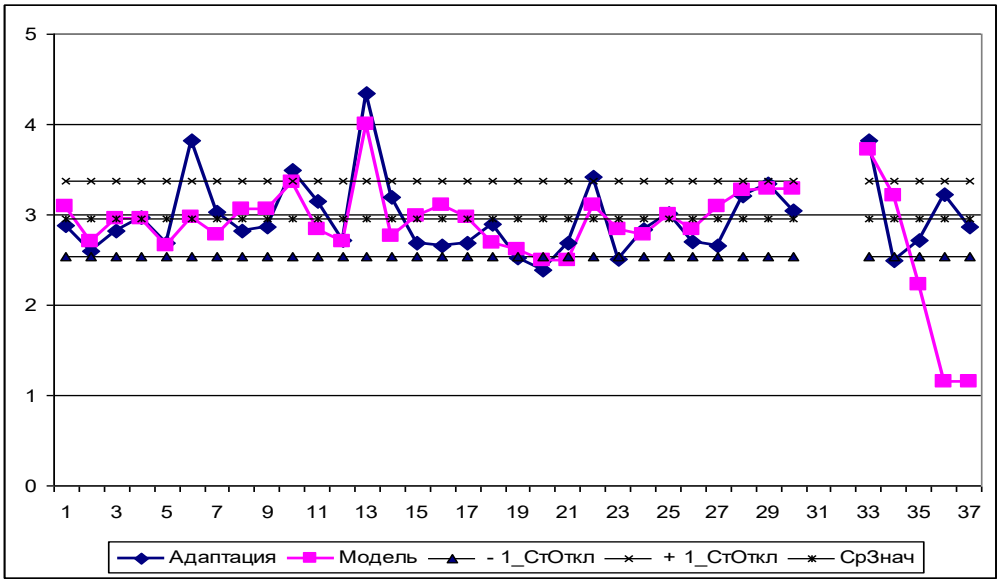


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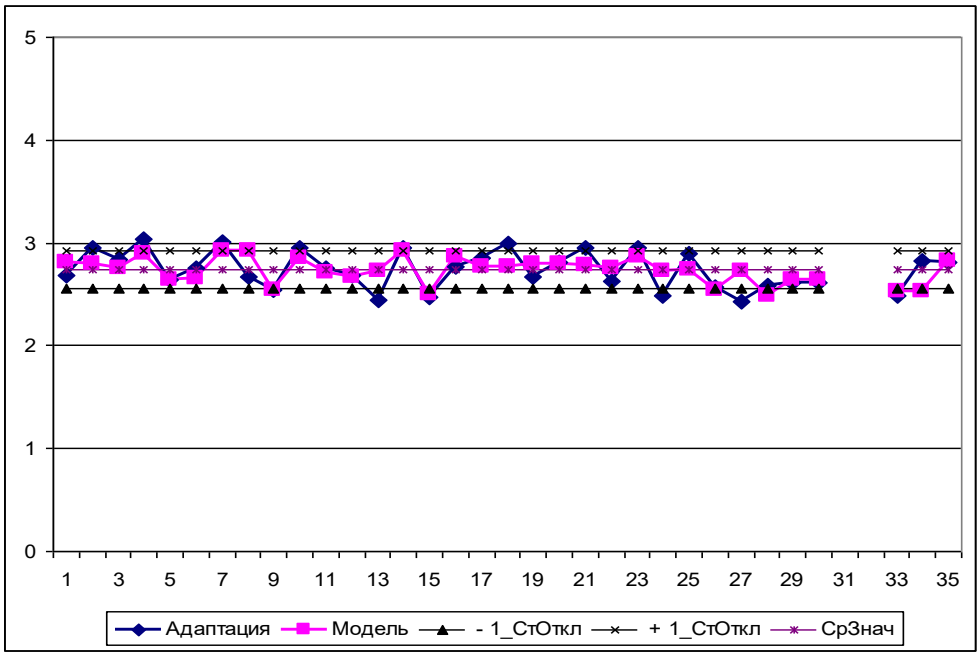
Figure 4: The dynamics of the actual model and obtained by the AP values in normal conditions the student A.



A large range of values and the sharp fluctuations of adaptive capacity at the compensated functional abnormalities appears to be a harbinger of depletion of adaptive capabilities of the organism, or a manifestation of the initial stages of developing a pathology that requires urgent intervention and strict medical supervision

CONCLUSIONS

This method can be used for medical and preventive purposes at transport companies (road, rail, aviation), where increased demands on the concentration of attention of the employee, as well as for the prevention meteodependent reactions in patients.

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