Telemedical system for individual *prenosological* health assessment


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Prenosological concept of the health level assessment [Baevsky, 2006].

- Homeostasis
- Adaptation
- Level of functioning of the key organs and systems
- Level of strain of the regulatory systems (stress level)
- Individual and age factors
- Functional reserves of regulatory systems and energometabolic support
- Environmental factors

Health level (Adaptive capacity of organism)
Types of Diagnostics

Prenosological

- Health
- Prenosological state

Disease

Nosological

Provides the name of the disease in terms of accepted classification and nomenclature of diseases

Human health condition at the borderline between health and disease
Functional state of the cardiovascular system is considered indicating the functional state of the organism as a basis of the adaptation processes.

The analysis of heart rate variability (HRV) is the key method of evaluation of the functional state (FS) of the organism. Starting with the first manned space flight [Parin et al, 1965], HRV is used to study the influence of various factors on humans.
The probability of achieving prenosological or premorbid states is the quantitative measure of health risks. These states differ from the normal states by significant shifts of the autonomic balance.
Heart rate variability (HRV) analysis was first used to assess health levels in space medicine. Now it is proven to be informative about health, including general health risks, cardiovascular conditions, various chronic disease conditions, aging, stress, fitness and more.
"Heart Wizard" instrument was originally designed for individual health and fitness assessment. Later it was customized for our collateral research project "Mars-500".

http://mars500.imbp.ru

www.iki.rssi.ru/mars500

http://www.biocomtech.com/
International crew

MARS 500

Satellite studies
Heart Wizard utilizes cloud-based client-server technology. Client software components are installed on local user machines to perform testing using pulse sensors. Measured data is transmitted to Heart Wizard Data Center located on the remote server for analysis and storage. When prompted test results are retrieved from the server and displayed on the local machine in the forms of specific test reports and history charts.
The study involved 4 male volunteers from USA (Poulsbo) and 6 male volunteers from Toronto (Canada). 5 subjects were from 45 to 52 years, and 5 - from 21 to 25 years. They conducted their tests weekly at their homes.
The investigation protocol included weekly 5-min ECG recordings combined with breathing tests, blood pressure measurements and filling out the questionnaire about day-to-day life, stress and health complaints of the past month.
Heart Wizard includes a simple inexpensive pulse sensor and special Windows-based software with simple and intuitive user interface.
Sit comfortably and limit your body movements.
The Heart Wizard provides users with valuable information about current health condition and its long-term history.
The analysis of test results confirmed the high sensitivity of HRV parameters to age-related shifts in the autonomic balance.
The probability of the normal functional states is decreased in older age group.

Our assumption is that people’s exposure to adverse factors increases their health risks.
Individual probabilistic estimation of health status in the course of longitudinal collateral studies “Mars-500” (1 – emotional stress, 2 – respiratory infection).

Functional deconditioning of this participant is mainly associated with stress at work and respiratory diseases. It is accompanied by increased probabilities of getting in prenosological states.
It is important that changes in the autonomic balance appear at early stages of the disease, before the appearance of the respiratory symptoms.
The probability of achieving prenosological or premorbid states is the quantitative measure of health risks. These states differ from the normal states by significant shifts of the autonomic balance.
3 years of *Heart Wizard – Mars500*

![Graph showing stress degree and functional reserves over three years for user 15. The graph includes data points for 2009, 2010, and 2011.]
3 years of *Heart Wizard – Mars500*

- **Stress degree**
- **Functional reserves**
- **User 1**

Data points for years 2009, 2010, 2011, and 2012 are plotted on the graph.
Comparison of elder groups (age>45 years) in North America (n=5) and Russia (n=21).

May be, we must change our thoughts about our health?
CONCLUSION

- Telemedicine technologies can significantly improve the quality of medical care by enabling remote monitoring and using new advanced methods of health assessment.

- The analysis of test data supports the hypothesis about close correlation between changes in the autonomic balance and effects of various factors (weather, emotions, morbidity, etc). Our method may help to monitor the effectiveness of preventive healthcare.
CONCLUSION

- The results demonstrated that weekly individual prenosological assessments can detect disturbances of the autonomic balance prior to appearance of any health problems as opposed to monthly examinations in the labs conducted in other regions.

- Individual prenosological health assessment is one of the promising directions in telemedicine.
Thank you for your attention!