# Telemedical system for individual _prenosological_ health assessment

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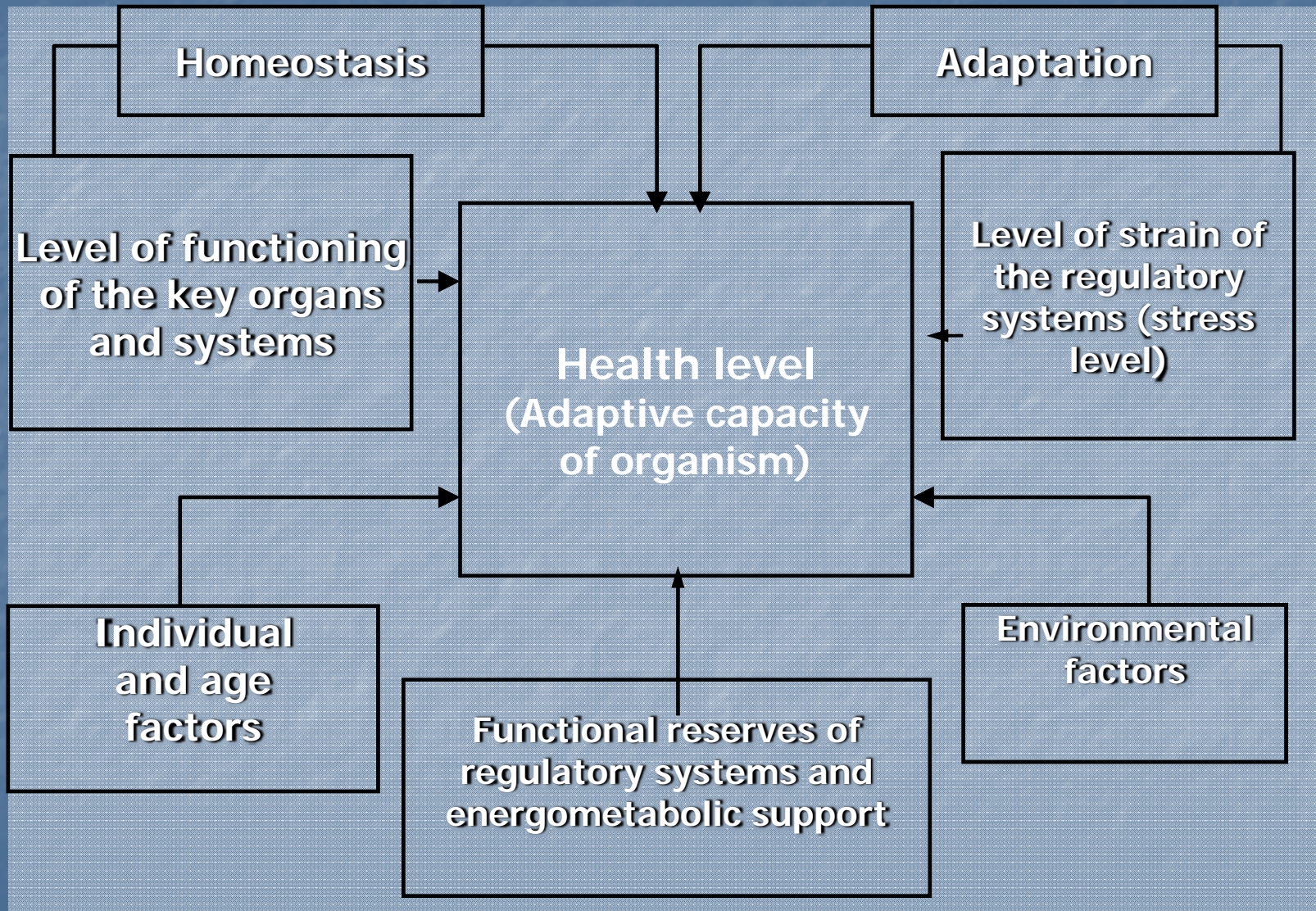
Types of Diagnostics

Prenosological

Nosological

Health → **Disease**

Prenosological state

Human health condition at the borderline between health and disease

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

Research methods and experimental data

- *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 space of functional states
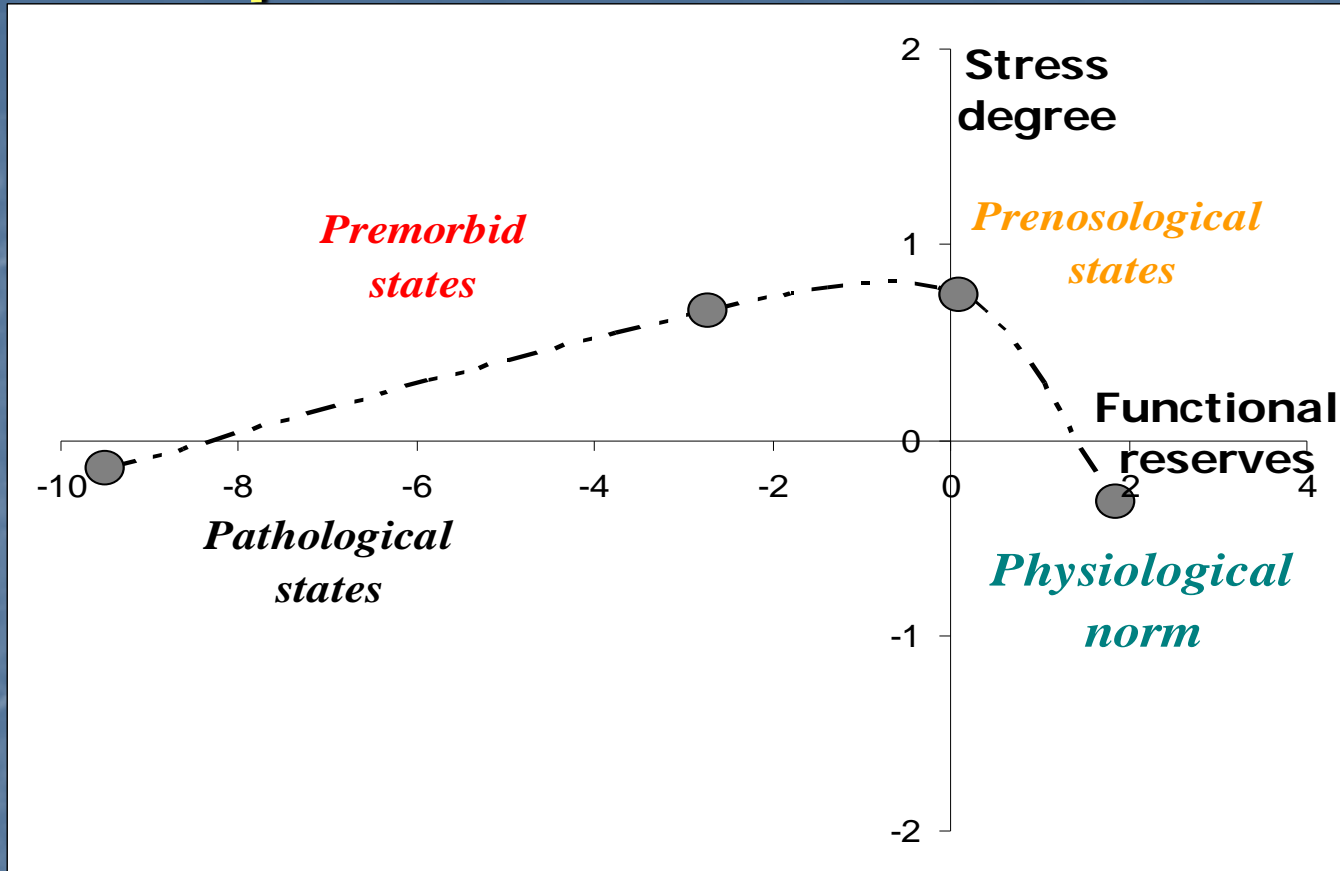
■ The probability of achieving prenosological or premorbid states is the quantitative measure of health risks. These states differ from the normal states by significant shifts of the autonomic balance.

Research methods and experimental data

- 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.

Research methods and experimental data

- **"Heart Wizard"** instrument was originally designed for individual health and fitness assessment. Later it was customized for our collateral research project **"Mars-500"**.
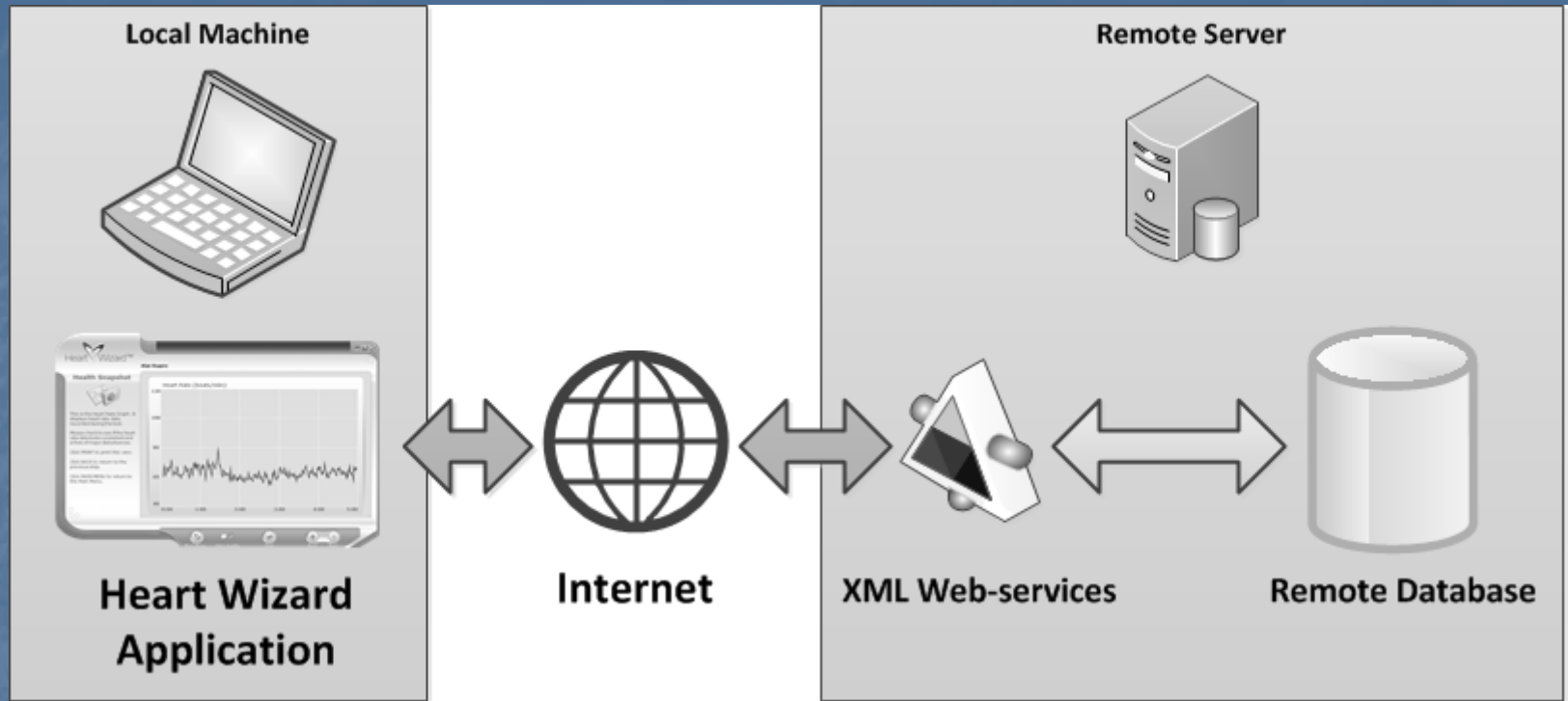
http://mars500.imbp.ru

www.iki.rssi.ru/mars500

http://www.biocomtech.com/

International crew

MARS 500

Satellite studies

photo: http://mars500.imbp.ru

Research methods and experimental data

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.

Heart Wizard™
Mars-500

Health Snapshot

Follow these instructions to prepare for the session.

Click NEXT to continue.

Click BACK to return to the previous step.

Click MAIN MENU to cancel this session and return to the Main Menu.

Sit comfortably and limit your body movements.

☑ Show next time

Main Menu

Back   Next

Main Functional Parameters:

Parameter	Value	Norms
Body Mass Index, m^2/kg	20	22 - 26
Heart Rate, bpm	58	55 - 75
Systolic Pressure, mm Hg	115	140
Diastolic Pressure, mm Hg	80	65 - 90
Physiological Shift Level	1,15	3,1
Arrhythmia %	0.3	0 - 4

Autonomic Regulatory State:

Parameters	Values	Norms
SI, c.u	60	50 - 175
pNN50, %	42	15 - 40
SDNN, ms	62	35 - 70
TP,ms^2/Hz	1038	

Main Health Risk Factors:

Risk Factor	Value
Worsening of well-being	No
Lowering of physical activity	medium risk
Worsening of psychological condition	No
Nutritional problems	low risk
Sleep problems	No
Increased sensitivity to environmental problems	low risk
Bad habits (smoking, alcohol)	No
Stress-related problems	high risk

Heart Wizard™
Mars-500

Test Summary

Select a specific Date to review your session report.

Click NEXT to proceed.

Click BACK to return to the previous step.

Click MAIN MENU to cancel this procedure and return to the Main Menu.

Select Specific Test/Session Report

- 04.04.2012 11:13
- 28.03.2012 11:12
- 22.03.2012 10:58
- 14.03.2012 22:04
- 08.03.2012 22:08
- 01.03.2012 11:11
- 23.02.2012 20:42
- 15.02.2012 21:42
- 09.02.2012 9:53
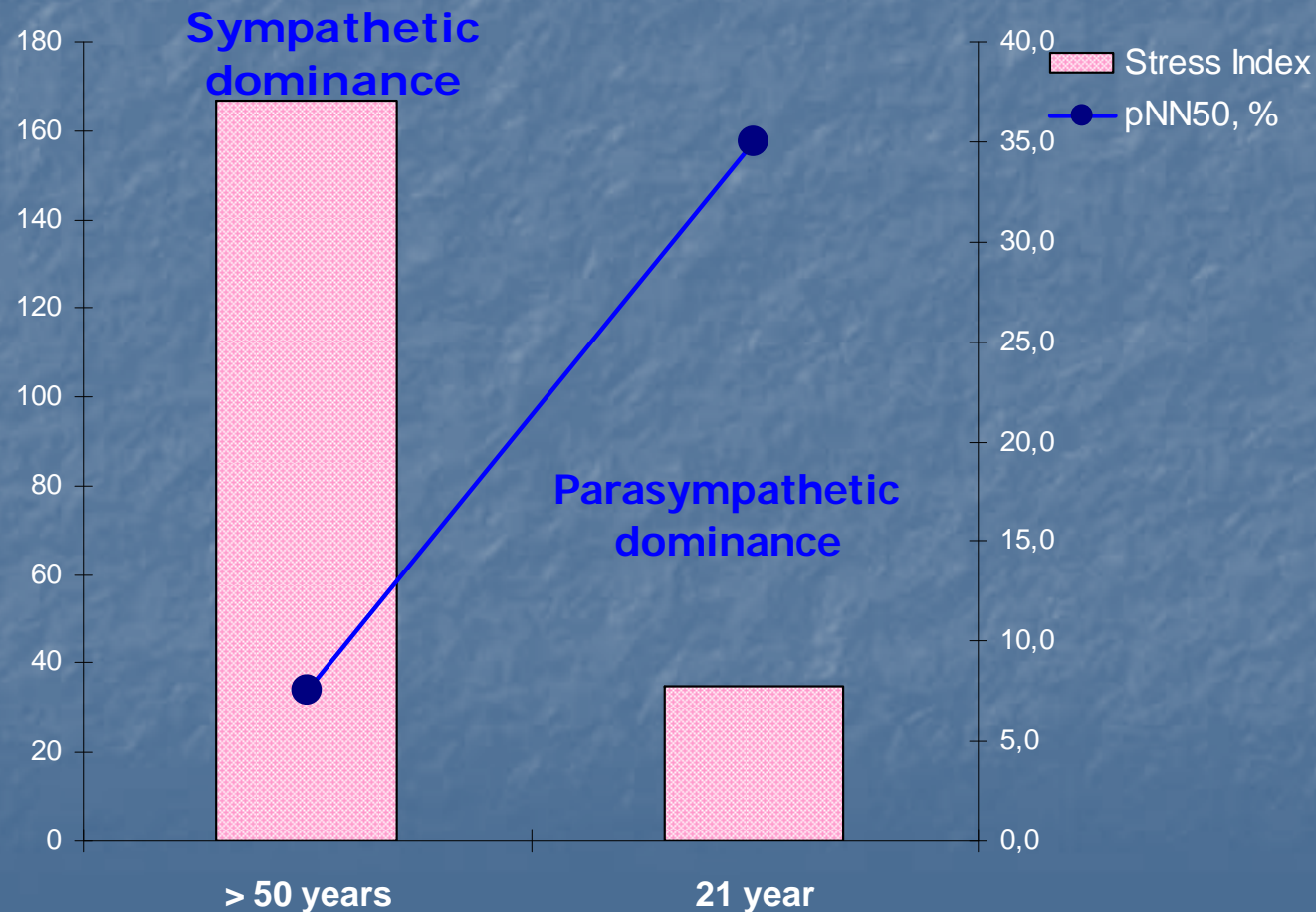- 01.02.2012 21:58
- 25.01.2012 22:15

Main Menu   Back   Next

■ 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
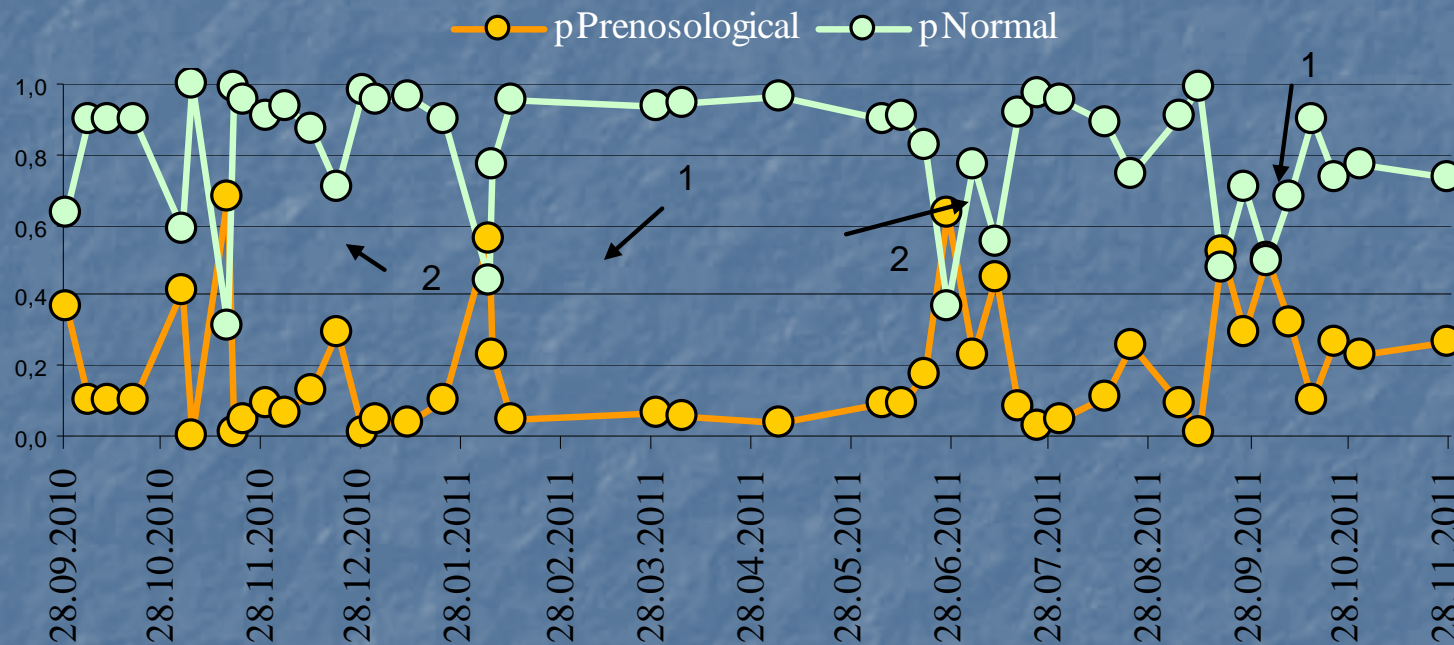
The probability of the normal functional states is decreased in older age group
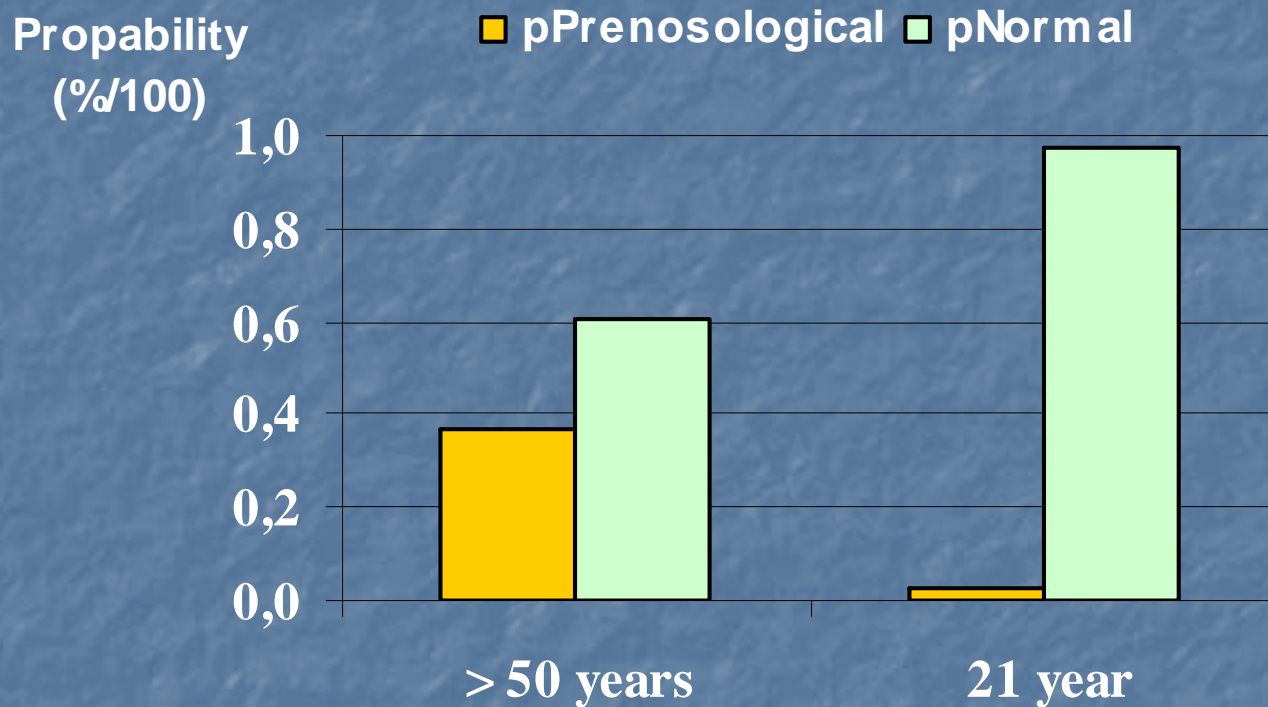
Our assumption is that people's exposure to adverse factors increases their health risks.

# 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.
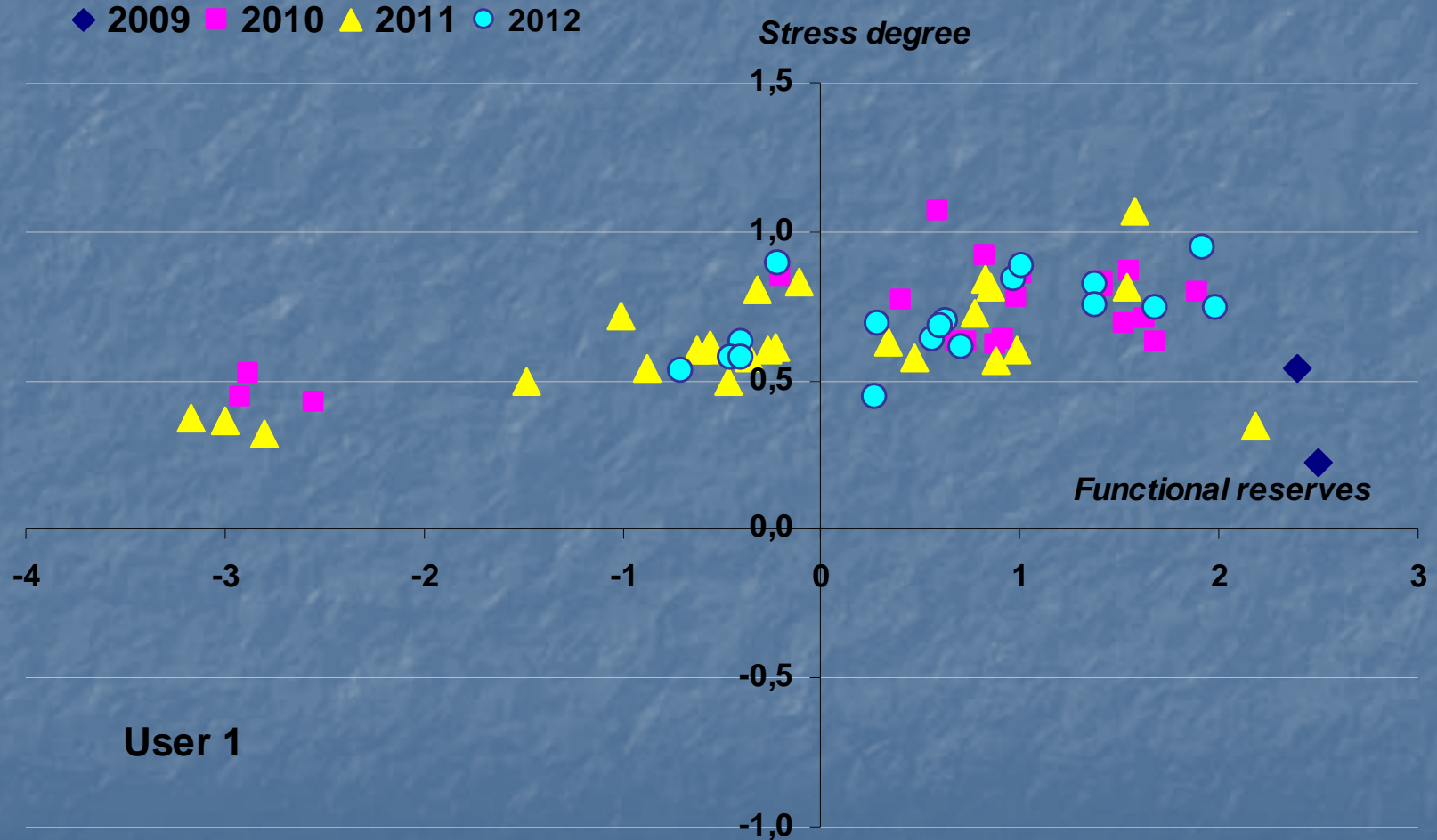
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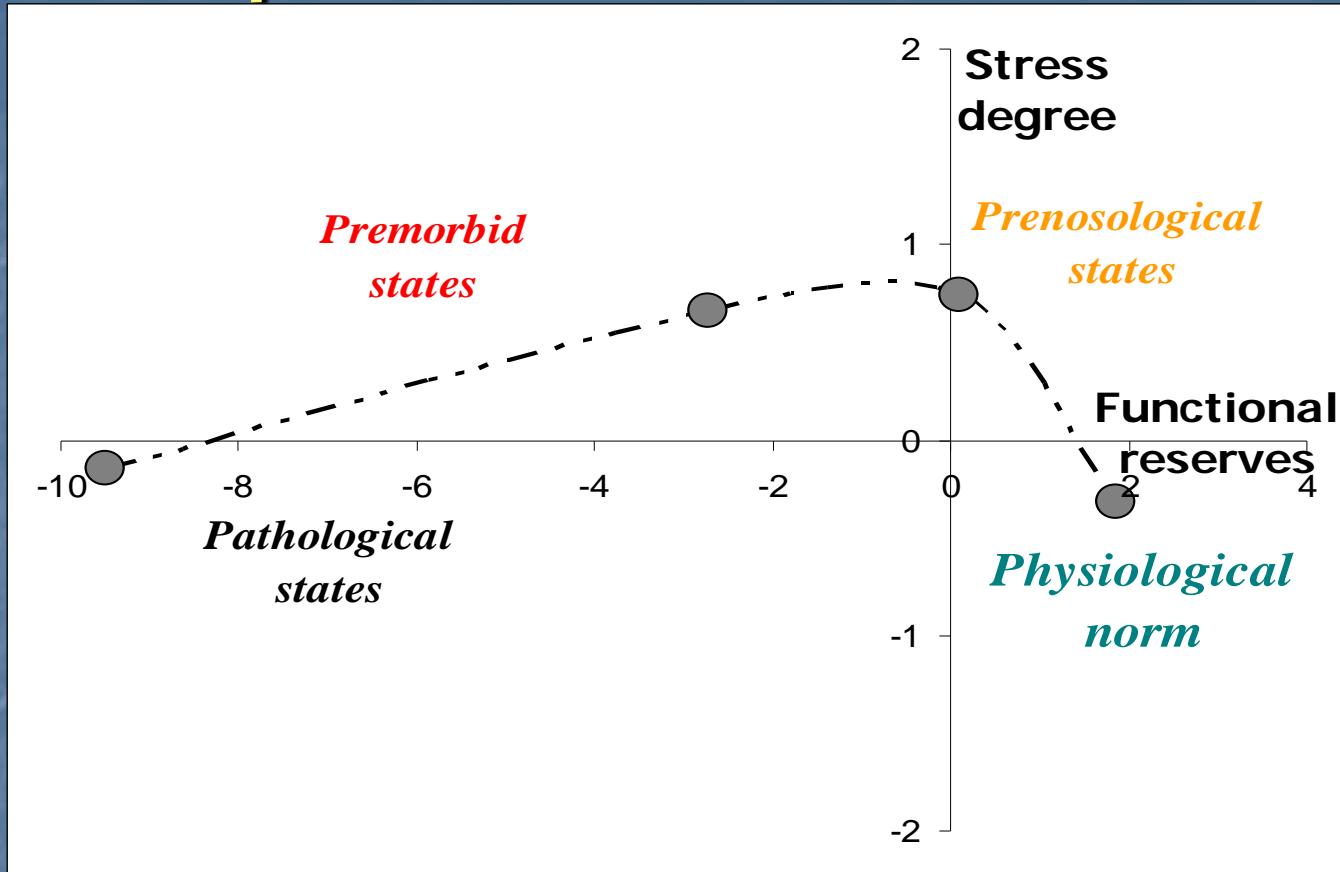
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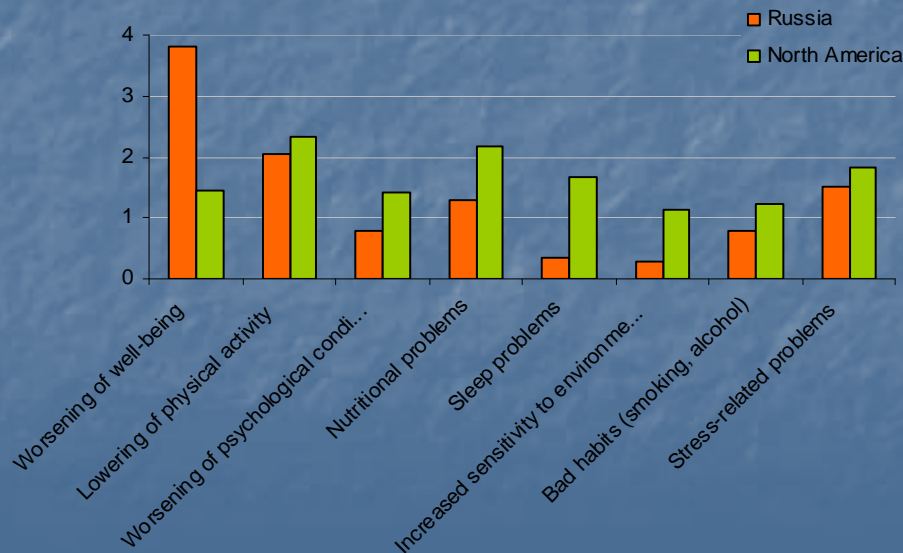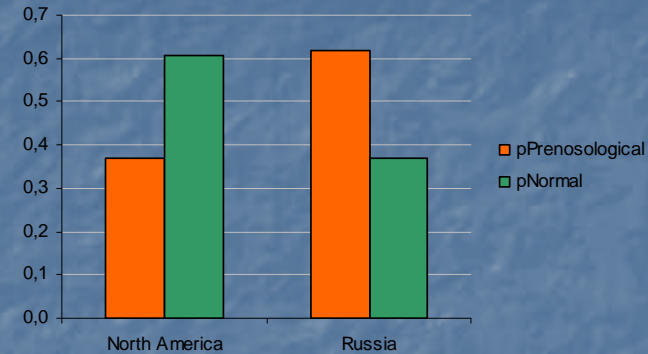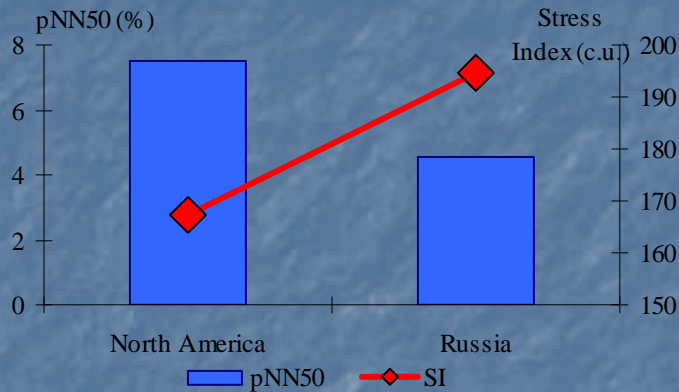
3 years of *Heart Wizard – Mars500*
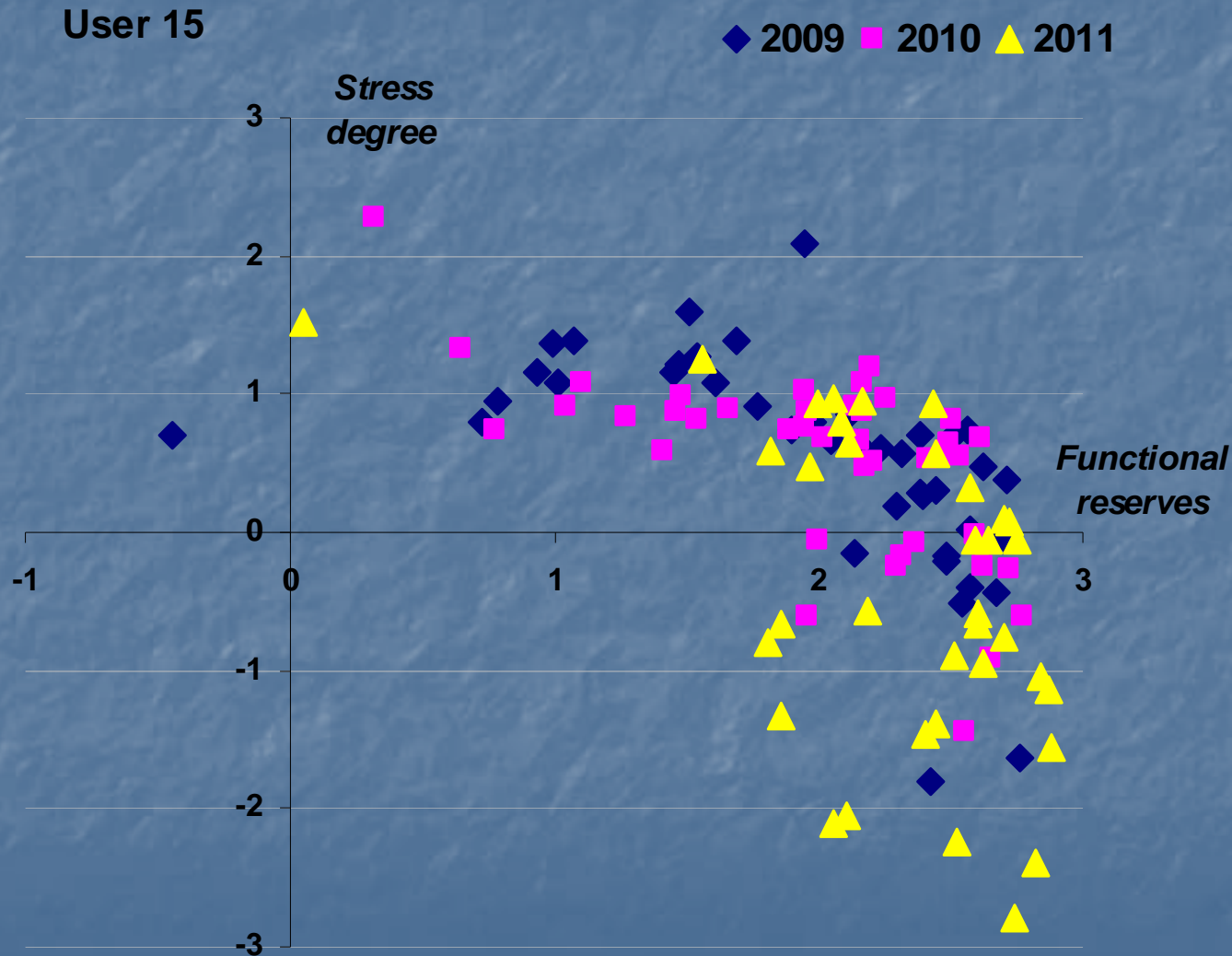
3 years of *Heart Wizard – Mars500*

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 assessement.

- 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!