



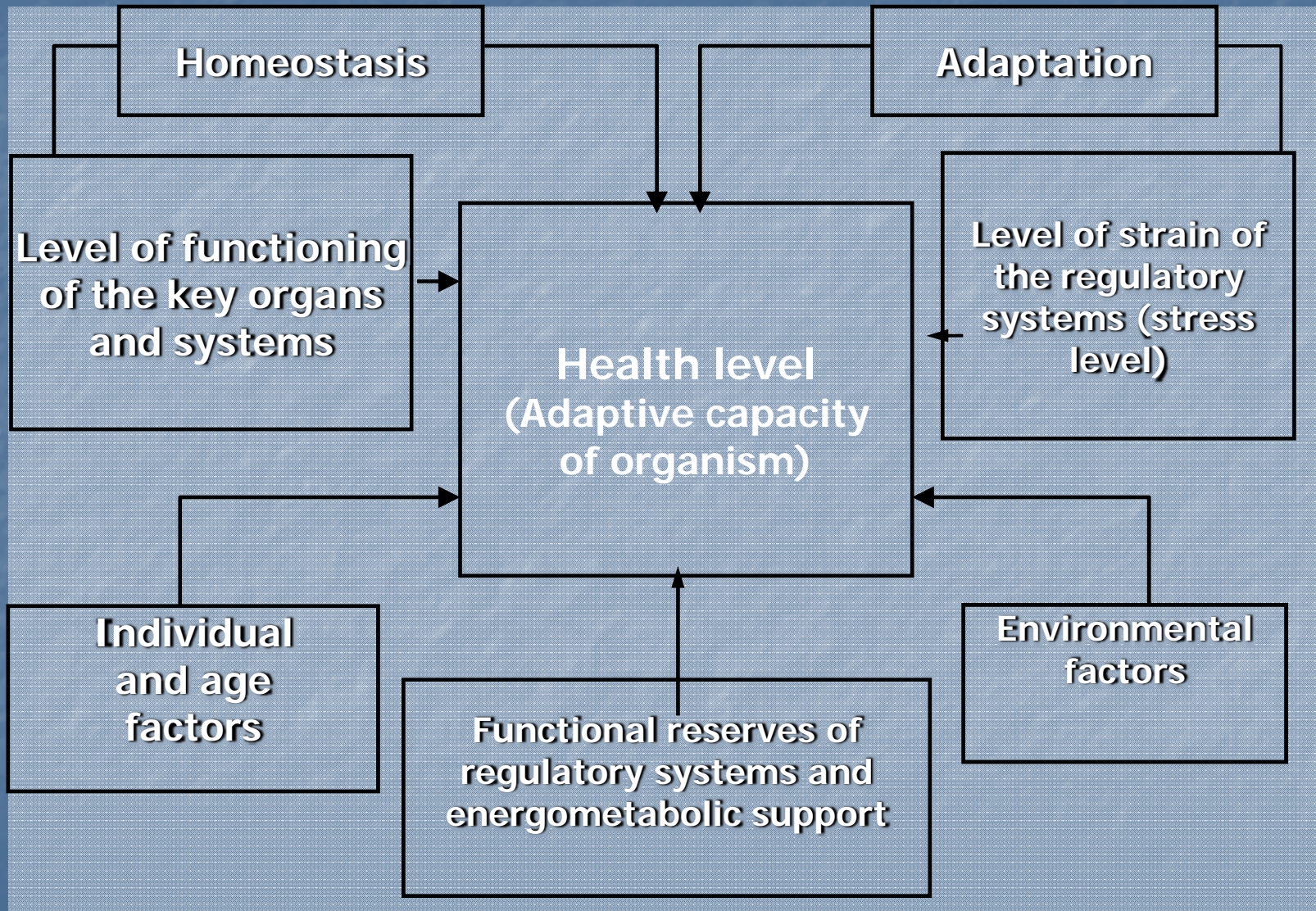
Telemedical system for individual *prenosological* health assessment

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



Types of Diagnostics

Prenosological



Health

Disease

Prenosological state

Human health condition at the
borderline between health and
disease

Nosological

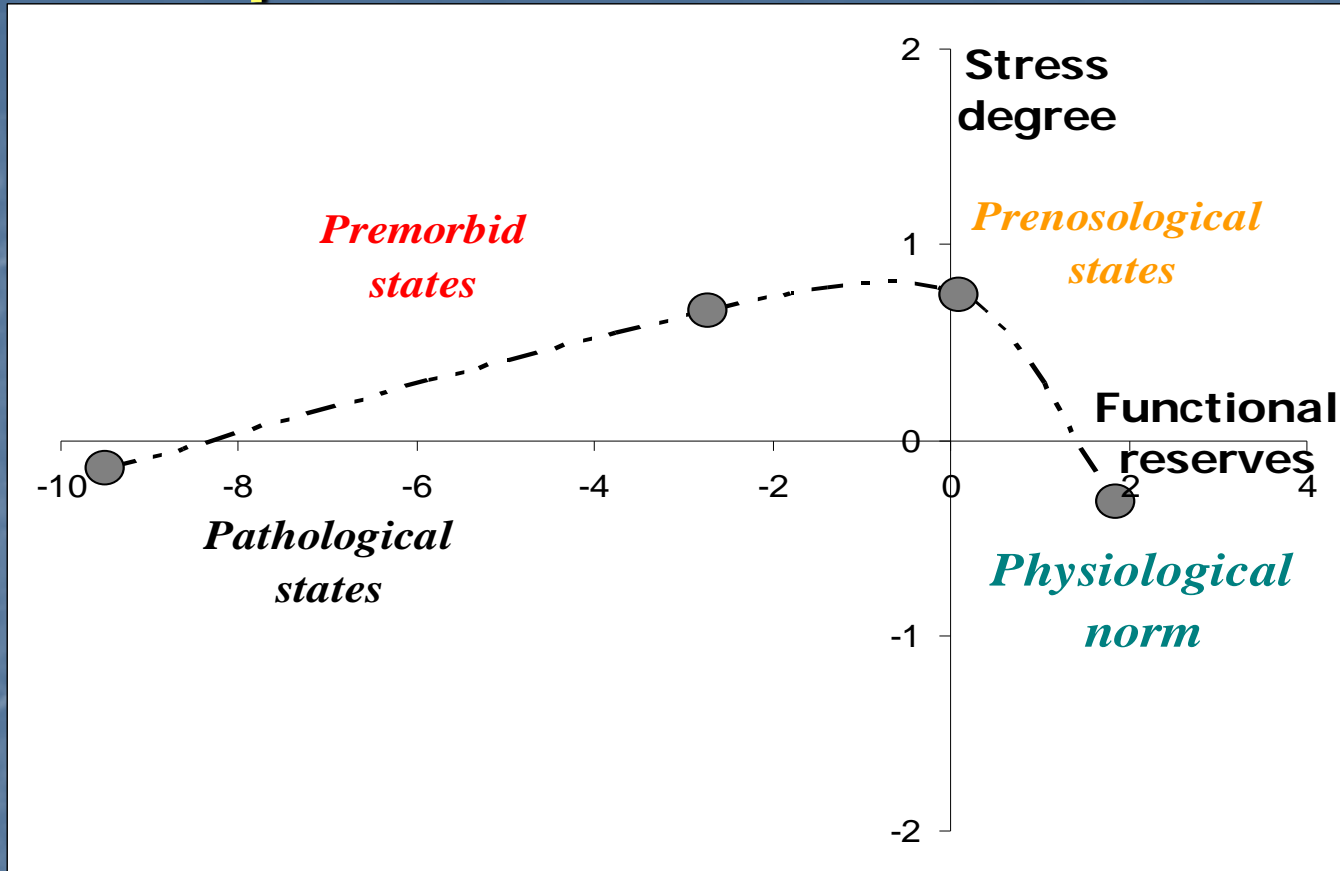


Provides the name of the
disease in terms of accepted
classification and nomenclature
of diseases

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



The screenshot shows the Biocom Technologies website. The header features the Biocom Technologies logo on the left and the tagline "Innovative technologies for better life" on the right. Below the header, a navigation menu on the left lists: Home, Products (Health Assessment, Stress Management), News, Heart Rate Variability, Relations (Our partners, Advisory board, Investors), and Customer support. The main content area includes the text "In Business since 1996" above an image of a computer monitor displaying HRV data. To the right of the monitor, the text reads "heart rate variability systems for Health, Stress and Fitness" with "for Health, Stress and Fitness" in orange. Below this, it says "normative database included" in green. Further down, it states "#1 choice of researches and USA leading Universities for physiological monitoring and stress management tools". A small image of a heart rate monitor device is shown to the right. At the bottom right, there is a button that says ">> Select now".

biocom
TECHNOLOGIES

Innovative technologies for **better life**

In Business since 1996

» Home

» Products

- Health Assessment
- Stress Management

» News

» Heart Rate Variability

» Relations

- Our partners
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» Customer support

heart rate variability systems
for Health, Stress and Fitness

normative database included

#1 choice of researches and USA leading Universities for physiological monitoring and stress management tools

>> Select now

- 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/>



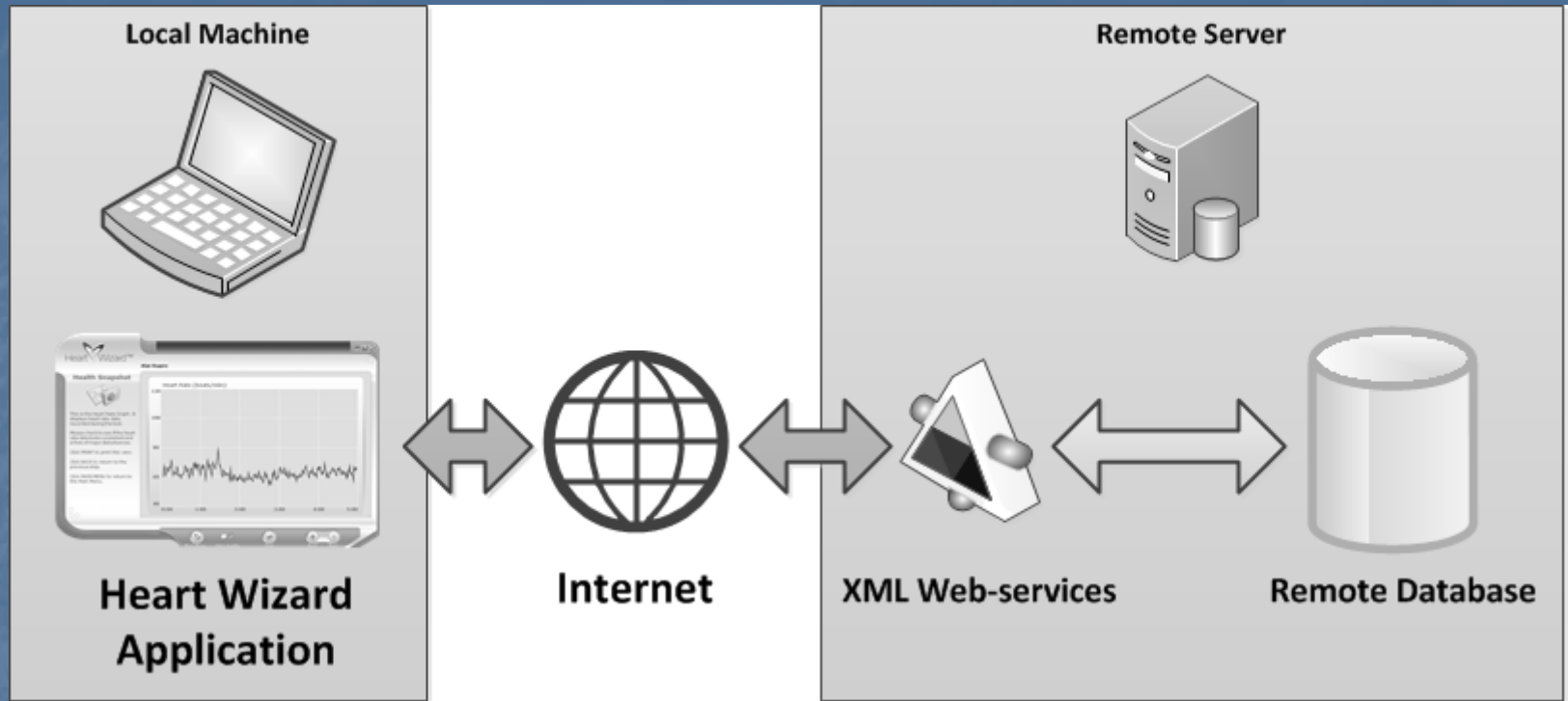
International crew

MARS 500

Satellite studies



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.



Select an appropriate
User Name of your client
you wish to work with
then click NEXT.

Select User

#	# User Name	Age	Gender	Last Tested	Last Date
010.	I, f4	31	Male	MARS-500	08/25/11
011.	I, f6	29	Male	***	***
012.	I, f7	31	Male	***	***
013.	I, f81	31	Male	MARS-500	05/23/10
014. [A]	I, f93	41	Male	***	***
015.	I, f95	31	Male	***	***
016.	I, f97	31	Male	***	***
017.	I, f99	31	Male	***	***
018. [A]	M1, A	50	Male	MARS-500	07/01/10
019.	Sergeev, Andrei	49	Male	MARS-500	04/04/12
020.	user1, f	8	Male	MARS-500	05/02/09
021.	user13, A Baevski Sr.	54	Male	MARS-500	05/23/10
022.	user16, f	42	Male	MARS-500	11/24/09
023.	user17, f8	31	Male	MARS-500	09/16/11
024.	user23, f5	31	Male	***	***
025.	user25, f	43	Female	MARS-500	05/04/09
026.	user26, f94	31	Female	***	***
027.	user27, f	31	Male	MARS-500	06/21/09
028.	user29, f29	83	Male	MARS-500	08/29/11
029.	user3, f96	49	Female	MARS-500	03/15/12
030.	user30, f30	86	Male	MARS-500	10/17/11
031.	user6, f98	31	Male	MARS-500	03/16/12
032.	user9, f82	31	Male	MARS-500	03/16/12



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- 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.**



Read this introduction page first and follow the instructions.

Click NEXT to continue.

Click BACK to return to the previous screen.

Select Your Testing Option

☒ Quick Testing Procedure

During this testing procedure you will complete a health questionnaire and take a 5-min test measuring your heart rate at rest.

☐ Full Testing Procedure

During this testing procedure you will complete a health questionnaire then take full battery of tests including measuring your heart rate at rest, during deep paced breathing, and during holding breath after maximum inhalation and exhalation.



Main Menu



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■ 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.

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.

You are about to start a new Health Snapshot test.

Make sure that the sensor is plugged into a USB port.



Attach the ear-clip to your earlobe or finger.



☒ Show next time



Main Menu



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- Heart Wizard includes a simple inexpensive pulse sensor and special Windows-based software with simple and intuitive user interface.

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



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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



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



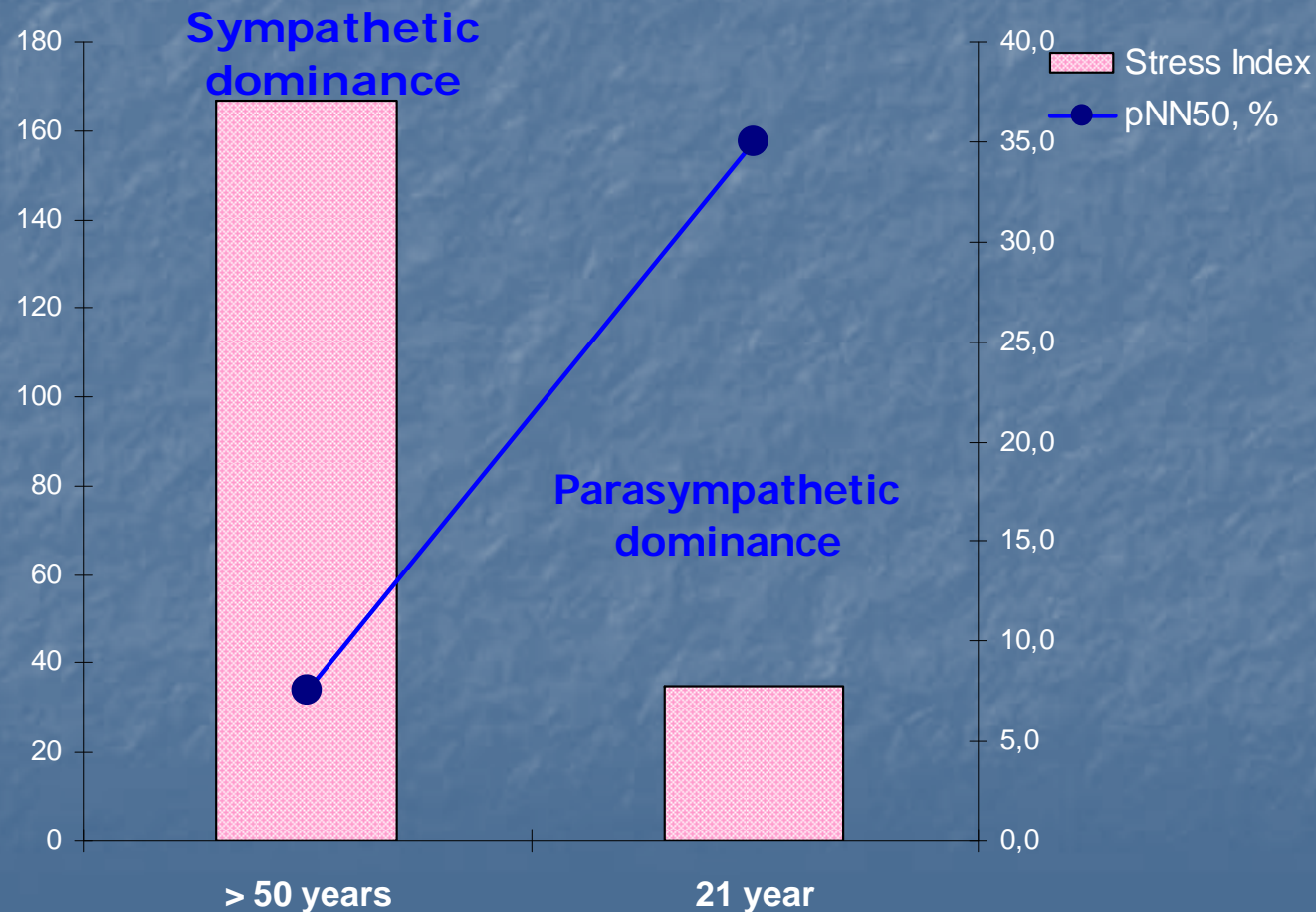
Back



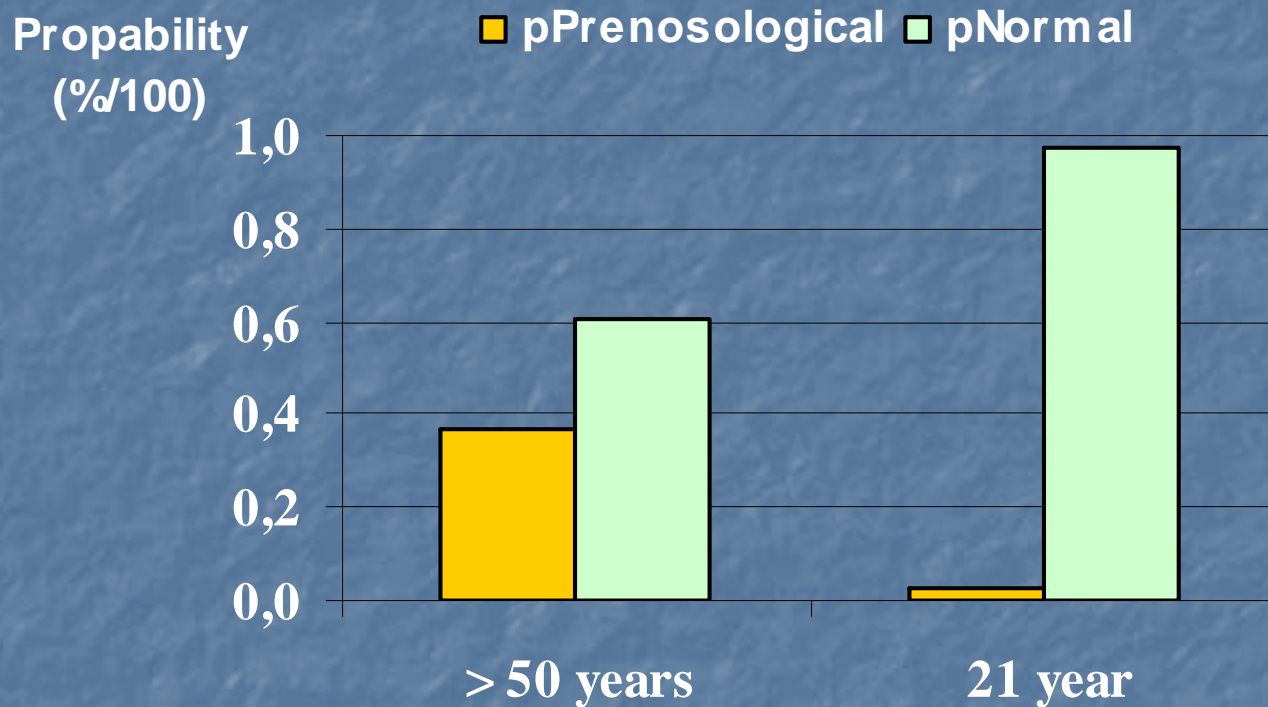
Next

- 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



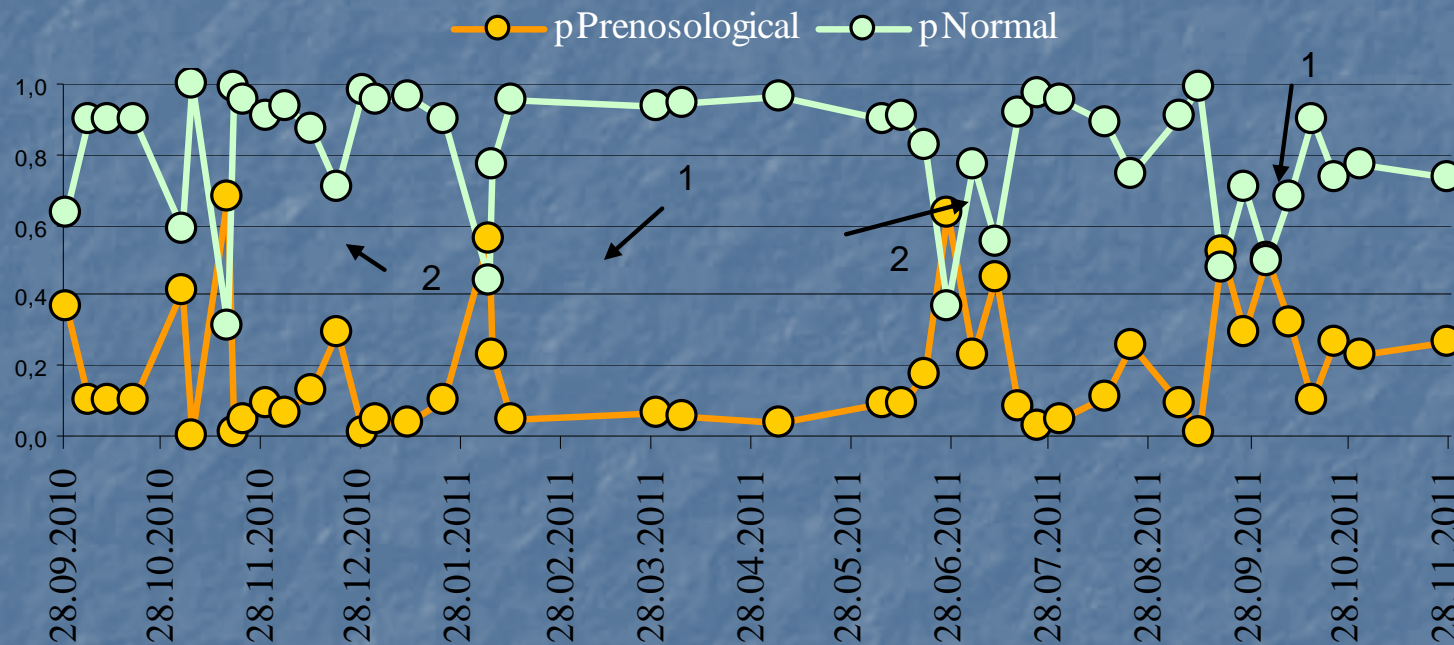
The probability of the normal functional states is decreased in older age group



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"

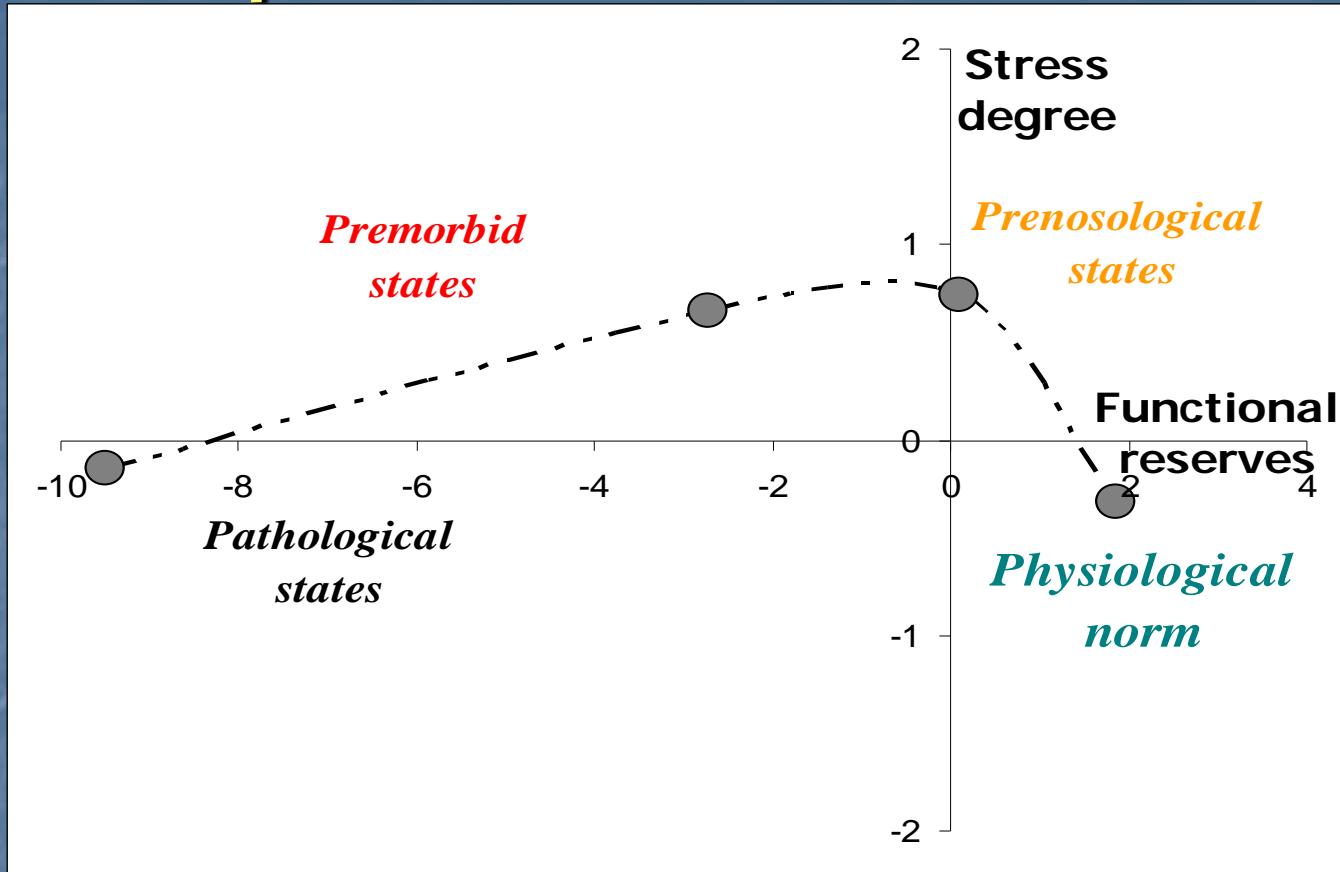
(1 – emotional stress, 2 – respiratory infection)



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.

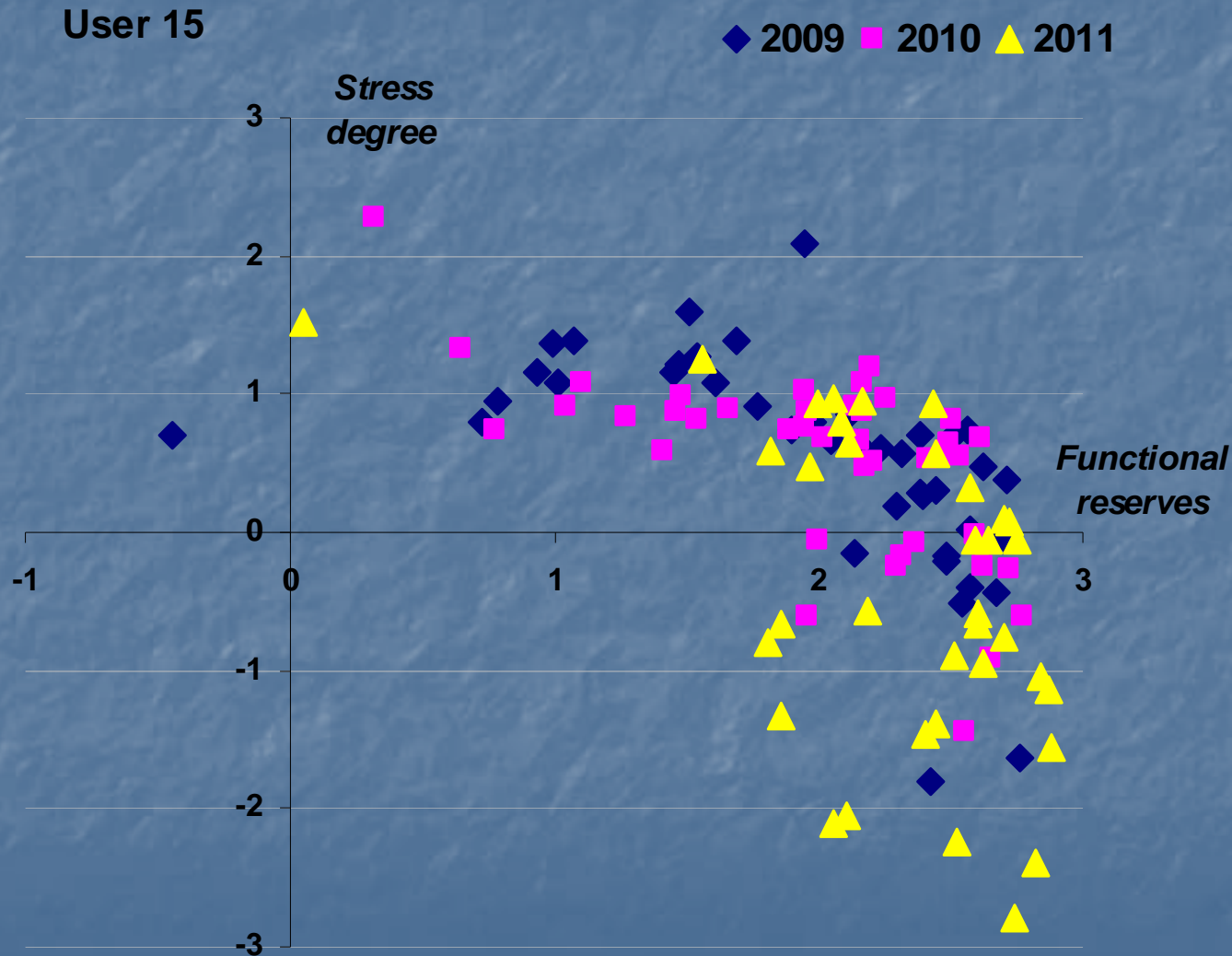
- It is important that changes in the autonomic balance appear at early stages of the disease, before the appearance of the respiratory symptoms.

The space of functional states

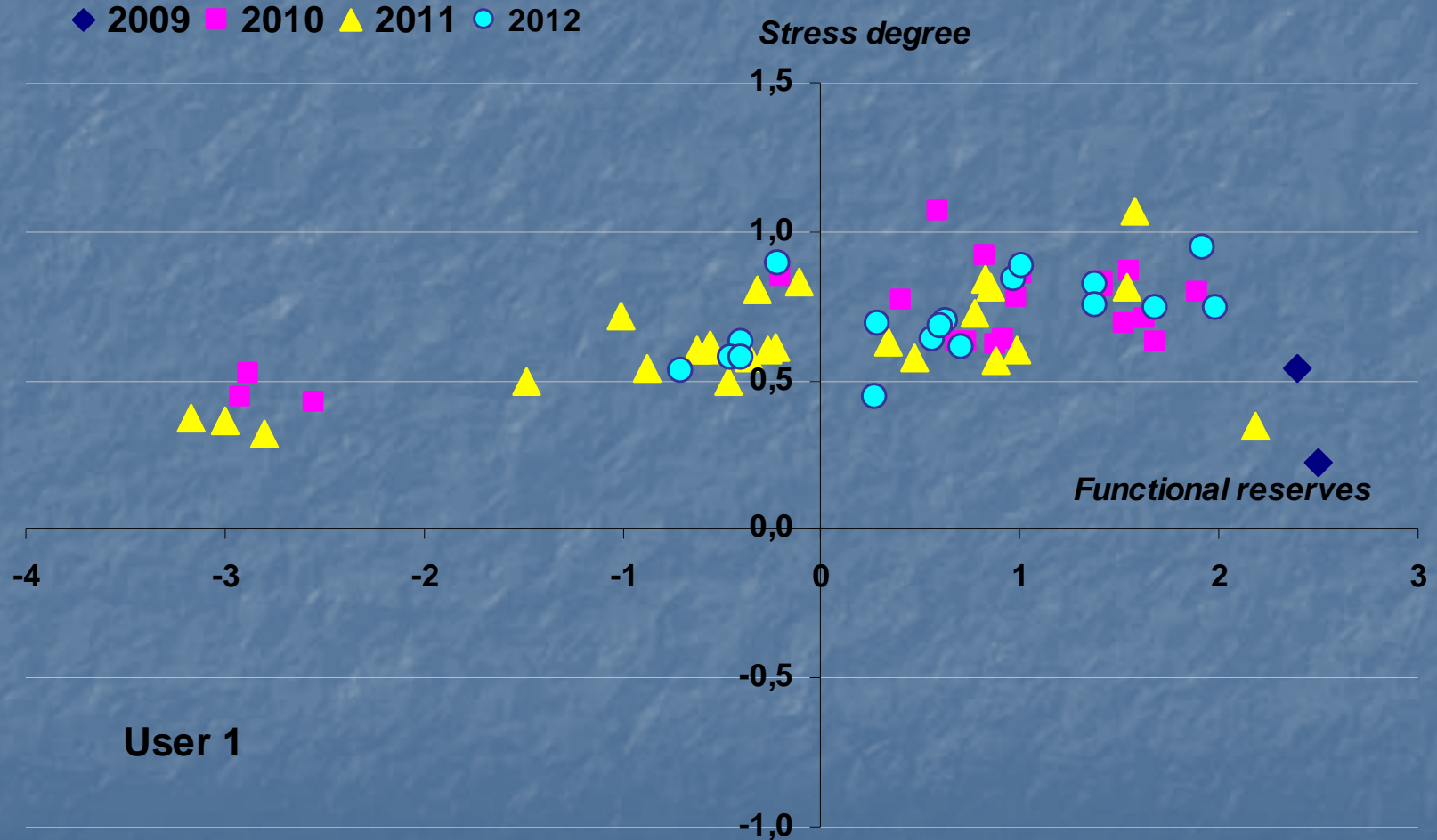


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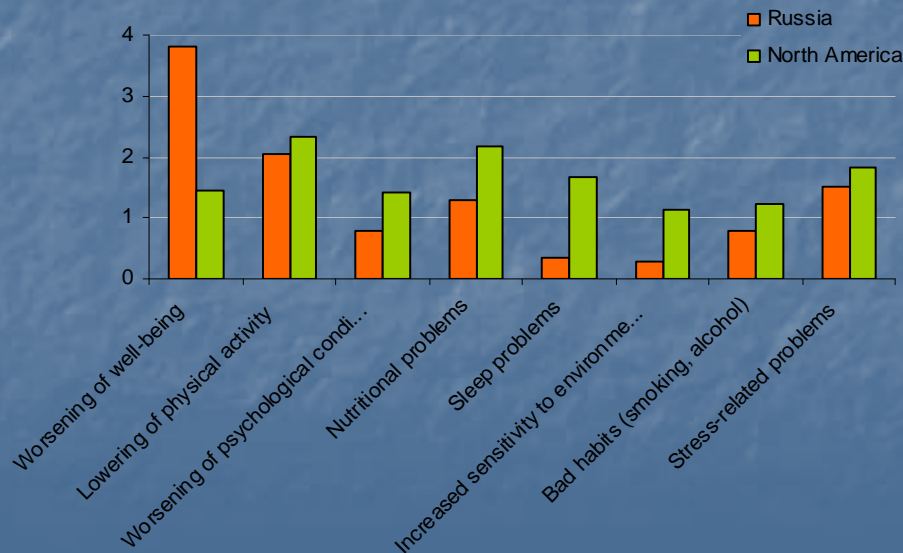
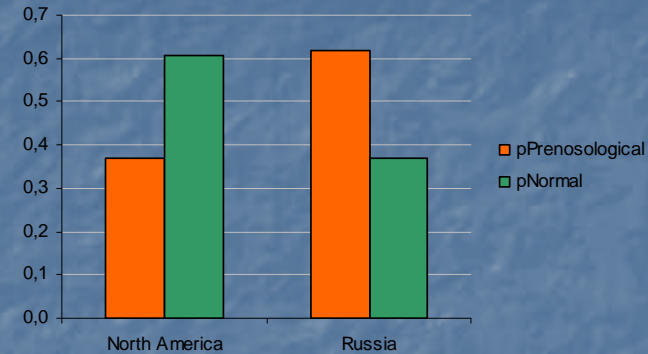
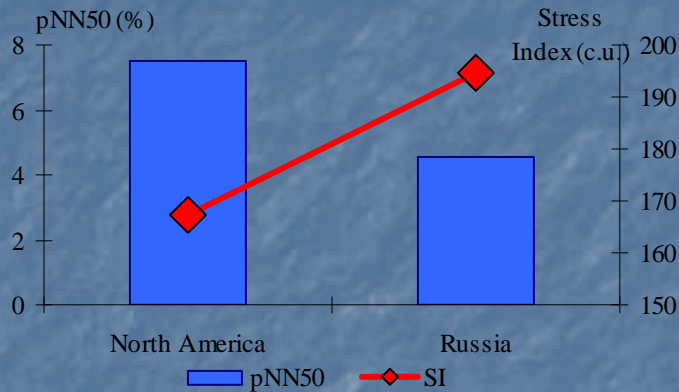
3 years of *Heart Wizard – Mars500*



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!