Value-based Healthcare in Russia: Implementation of Medical Biosensors

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Study of biosensor systems used to cure and monitor socially important diseases:

• Existing technical solutions.;
• Marketing;
• Experts survey;
• concept of full cycle integrated project “Development of distant medical care"
Why do we need medical biosensors?

- Social impact. Aging of population, territory issue
- High-tech medicine, distant medicine, personalized medicine
- Mass demand
- New jobs
- Life level
Criteria

1. Mobility
   - Implanted or non-detachable part (as RFID chip)
   - Personalized treatment (as blood sugar analyzer)
   - Hold/carried device (as halter)
   - Specialized small non-personalized device (mobile ambulance)

2. Priorities
   - Arterial pressure
   - ECG
   - Blood sugar level
   - Blood clotting

3. Possibility of distant control and computing
   - Technologically
   - Institutionally

4. Parts of the devices - sensors

5. Stage: ready for implementation in the short term

Results

212 items, grouped in:
- cardio
- cohelear
- Sugar in blood
- gastrointestinal
- neurostimulators
- Sport and others
- additional
Market peculiarities

- Oligopoly (Medtronic, Boston Scientific, Biotronik, St. Jude Medical)
- vertically integrated structure
- The growth of the world market of biosensors will be determined by the growth of markets in the United States and the developed countries of the West.
- The rate of growth in the next - 5 years will be high, about 11% per year, further slowdown will come up to 7% a year.
- For Russia there are two versions of biosensors market: Inertial (western way repeated with some delay); or innovative (about 2 bln. euro by 2020).
Dream biosensor

- universal medical device (Easy-to-produce, ready-to-use devices);
- Relevant to telemedicine development based on smartphones use;
- Demand from both people and authorities (price, effectiveness, reliability);

- **Minimization**: the less the better
- **Passive device.** No impact, just gather the information and transfer data
- **Easily implantable.** Can be injected by a simple procedure
- **Materials used**: biodegradable polymers, battery included (or on other principles, not charging device)
- **Wireless**: data transfer, loading battery (e.g. adhesive patch)
- **No influence on habitual life** (size, type, etc.)
- **Working period**: 1-6 months
- **Price.** Cheap
Main parameters to collect:

- Body temperature
- Blood pressure
- Glucose level
- Blood analysis (ferments and enzymes)
- Oxygen level
- EKG
- Location (on demand)
Existing prototypes

- temperature: 'smart' pill by Ohio State University, USA
- Arterial pressure: EndoSure® Wireless AAA by CardioMEMS Inc, USA
- Glucose level: GlucoChip™ by PositiveID Corporation Headquarters, USA
- Blood analysis: Chip EPFL by EPFL, Switzerland
- Oxygen in blood: B-Care5 Blood temperature and SpO2 monitor by SORIN GROUP, Italy
- EKG: Reveal™ and Reveal Plus™ by Medtronic, Inc, USA
- Biodegradable polymers: RESOMER® by Evonik Industries AG, Germany; biodegradable battery: UCLA, USA, Ph. D Richard B. Kaner and StoreDot, Israel;
- location: Chip (RFID) by Xega, Mexico (chip to ne injected in an arm).
- Battery charging: Nyxoah system by Nyxoah, Belgium adhesive patch
Obstacles

Institutional (laws, rules, standards, etc.);

Data (privacy, principles to collect and transfer)

Managerial (biosensor is not something per se, but just a part of a whole cycle)

Staff (qualified personnel)

Economical (mass production, price)

Technical issues (biocompatibility, battery, 3-D printing)
Vast territories

Life expectancy

People’s demands

Expenditures

Low population density
Governmental politics

Venture money

Investing money/technologies from abroad

- Economics drivers (new branches development)
- “Pushing” projects (promote cooperation between science, business, technology)

**List of priorities (Ministry of Economical Development)**

- **Information and communication technologies**
- **Micro- and radio-electronics**
- **Satellite geolocation technologies**
- **Biocompatible materials**
- **New medical equipment development and implementation**
Full cycle integrated project:

- From “medical” viewpoint
  - New standards definition based on eHealth (telemedicine)
  - Implantable medicine development

- From “technological” viewpoint
  - IT technology for data handling (cloud technology, data transmitting, data privacy)
  - Practical fabrication of implantable medical sensors
Full cycle integrated project: steps in time

1 stage. IT technology development is sufficient. Medical technology needs improvement:

- usage of foreign sensors and devices. Pre-critical selection and adaptation to the Russian requirements
- Localization
- Launch of number R&D projects in that field in Russia

2 stage. formation of the Russian branch of the instrument and the telemedicine should take place

3 stage. the incorporation of eHealth into existing medical industry

Main world-wide trend of implantable biosensors: not the device (nor a patient himself) is the end of the process, but rather the medical service
Expected outcomes

- reduction in health expenditure (up to 6% government guarantee program - about $20-30 bln euro in 6 years).

- increasing life expectancy of the population (up to 12% reduction in mortality and disability in the population, primarily working age (30%) reduction in time-consuming patients to receive medical care (50%)

- about 2 bln euros of governmental funding in 2016-2017
Role of experts’ community

• To popularize eHealth in Russia
  ◦ 57% in Russia are not satisfied with existing medical service, 40% would prefer to go abroad for medical treatment. 21% of people point at poor equipment as the reason for weak medical service, 23% sees the incompetence of the staff as main source of bad health care, and only 6% suppose Russia develops high-tech economic sectors;

• To promote selected technical and managerial decisions to authorities
Thank you for your attention!