

# ОГЛЯДИ ТА ДИСКУСІЇ

*Actori incumbit onus probandi!*

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## Systematic review of medical software solutions in Bulgaria

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### РЕЗЮМЕ, ABSTRACT

The presented here systematic review is conducted to examine and summarize research, developments and technical characteristics of selected software solutions in the area of Bulgarian medical software field. Key findings indicate that developments in the field of medical software are sparse, with a limited range of focus and research methodologies. Greater effort using empirical research approaches is necessary for the improvement of current research in medical software certification. Bulgarian medical practice is recognized and proved as a professional and correct, but still there are some lacks like computer investigations and statistical backgrounds, as well digitized results for lots of rare and not so popular diseases, regardless of the enormous database of paper records, lack of suitable software solutions and experts to work with. We have searched and analyzed these problems, and based on the results we have developed specialized software systems for different purposes and research areas (Ukr.z.telemed.med.telemat.-2011.-Vol.9,№2.-P.204-211).

**Keywords:** Telemedicine, e-Health, Medical Information System, Data base, Software

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### СИСТЕМНЫЙ ОБЗОР МЕДИЦИНСКИХ ПРОГРАММНЫХ ПРОДУКТОВ В БОЛГАРИИ

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Данный обзор предназначен для исследования и обобщения научно-исследовательских данных и технических результатов использования ряда программных решений, используемых в системе здравоохранения Болгарии. Ключевым аспектом является стремительное развитие медицинского программного обеспечения на фоне отсутствия четкой методологии. Серьезные шаги должны быть сделаны для разработки научно обоснованной сертификации медицинских программных приложений. Болгарская система здравоохранения является высокопрофессиональной, однако имеется ряд проблем, связанных с недостатком компьютерной инфраструктуры, статистического анализа, накопления цифровых данных взамен бумажной документации, нехваткой качественного программного обеспечения и специалистов для работы с ним. В соответствии с выявленными аспектами и проблемами мы провели исследование, в результате которого было разработано медицинское мультизадачное специализированное программное обеспечение (Ukr.ж.телемед.мед.телемат.-2011.-Т.9,№2.-С.204-211).

**Ключові слова:** телемедицина, електронне здравоохранение, медицинская информационная система, база данных, программное обеспечение

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### СИСТЕМНИЙ ОГЛЯД МЕДИЧНИХ ПРОГРАМНИХ ПРОДУКТІВ У БОЛГАРІЇ

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Даний огляд призначений для дослідження й узагальнення науково-дослідних даних і технічних результатів використання ряду програмних рішень, що використовуються у системі охорони здоров'я Болгарії. Ключовим аспектом є стрімкий розвиток медичного програмного забезпечення на тлі відсутності чіткої методології. Серйозні кроки повинні бути зроблені для розробки наукової обґрунтованої сертифікації медичних програмних додатків. Болгарська система охорони здоров'я є високопрофесійною, однак є ряд проблем, пов'язаних з недостатністю комп'ютерної інфраструктури, статистичного аналізу, накопичення цифрових даних замість паперової документації, нестачею якісного програмного забезпечення й фахівців для роботи з ним. Відповідно до виявлених аспектів і проблем ми провели

дослідження, в результаті якого було розроблене медичне мультизадачне спеціалізоване програмне забезпечення (Укр.ж.телемед.мед.телемат.-2011.-Т.9,№2.-С.204-211).

**Ключові слова:** телемедицина, електронна охорона здоров'я, медична інформаційна система, база даних, програмне забезпечення

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The field of medical (health) informatics broadly addresses the cognitive, information processing, and communication tasks of medical practice, education, and research by focusing on the development of computer-based patient records, decision support systems, information standards, data aggregation systems, communication systems, and educational programs for patients and health providers. This expanding field is facing challenges to develop, for special populations, technology solutions that acknowledge the unique needs of these groups [4-5].

Since the introduction of computer software into the field of medicine in the 1950s, the number of computer programs deployed in health care has increased. Today computer software has become essential and pervasive in many facets of medicine. At the same time, computer software used in medicine has evolved from programs of simple logical processes to computer programs that are highly complex. Examples of complex tasks performed by computer programs currently include controlling safety critical medical devices, monitoring output of patient data from devices, calculating treatment dosage, analyzing patient data, and making risk assessment and treatment plans. These computer programs in health care bring new opportunities of better patient care; however, they also pose new risks of patient injuries and death.

To summarize the existing evidence concerning a treatment or technology e.g. to summarize the empirical evidence of the benefits and limitations of a specific agile method:

- to identify any gaps in current research in order to suggest areas for further investigation;
- to provide a framework/background in order to appropriately position new research activities.

By definition medical software is a unique complex of technology (technical resources) and methods (methods) for permanent collection, archiving, processing, analysis and dissemination of specialized data and information management, used in biomedicine and health care.

We offer one modern classification of medical activities where the software applications ensure new, higher performance, according to the specialized activity that helps [1-3]:

1. Diagnosis: identifying the etiology and pathogenesis of disease in recorded clinical symptoms - versions of IP-based computer models and epidemiological studies.
2. Treatment: bidding regimens examples and expert choice in managing and control of diseases. Here we can mention various reminders, dosages, compatibility between various drugs and pharmacy-tracking tasks, and control of warehouses of hospital pharmacy.
3. Screening: mass verification and registration of selected socially important diseases, which ensure monitoring of abnormality or the presence of risk factors in selected occupational groups.
4. Rehabilitation: regimens to restore and maintain country health status, based on "best practices" and epidemiological studies.
5. Prevention: protection against diseases through surveillance, establishment of prognostic information systems and computer statistics, modeling of epidemics and pandemics.
6. Statistical and epidemiological studies, specialized for all levels - from local to national, which are the basis for developing information-based management strategies and health policies.
7. Management - administrative, resources, knowledge, and all legal and regulating standardization schemes.

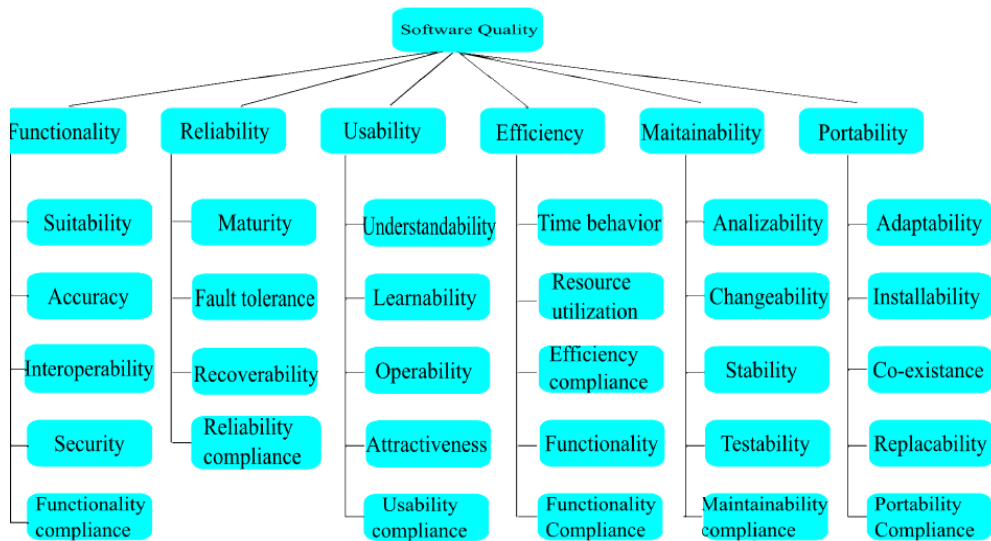


Figure 1. Quality characteristics of information systems of ISO/IEC 9126

Software solutions.

We would present a kind of programming portfolio, consisting of different realized solutions, developed, implemented and functioning at the current moment. Depending on the release year, we have generated lots of exploitation statistics, opinions and clinical

material; as well others are just being introduced and starting to work. We will follow the timeline of the developments, brief description of special characteristics, one screen per software, where and at how many workstations is introduced and results up to the current moment (fig.2).

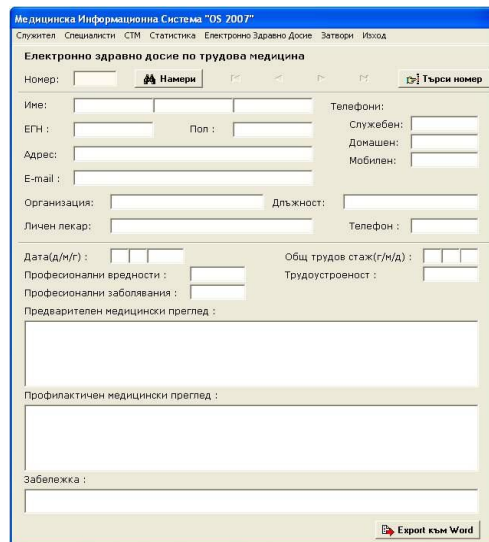


Figure 2. IS for occupational services Dasian

Information system for occupational services Dasian – v.2005.

The information system (IS) is with remote access, where user activates the product with generation of unique ID number, interconnected to the PC's ID. Dasian performs Export to WORD, spelling and input check-ups. It is used by one doctor, but it has 1000 patients entered from 12 companies. It ensures the annually required report,

guarantees patients safety and follows the law requirements for safety workplace.

Hospital Information System Svogiq – since 2006.

Hospital Information System (HIS) is our biggest solution, introduced into a hospital. The System works within LAN and Internet, exports to Word and Excel, checks-up for correct data input, generates numerous statistics with charts. It is ensured authorized entrance through username, password and

digital signature, with different access levels. HIS Svogiq is based on a module solution with 4 separated modules connected to one database. At municipality Svoge there isn't other Hospital and the population of 24640 people, determined into 3 main age groups – under 18 – 4250, between 18 – 64 – 15 500 and above 65 – 2900, is basically registered and treated by HIS Svogiq. For the 5 years working period there are generated 17 000 Electronic Health Histories and based on the statistical apparatus, are determined and evaluated the specific for the region diseases. In this evidence based way is performed preventive medicine for the population; medical doctors have at their disposal the necessary information to manage the

medical, administrative, financial and legal aspects of the hospital and its service processing (fig.3).

Medical Information System (MIS) Imunolog – since 2007.

Software solution “Imunolog” is developed after winning international project between University Hospital Alexandrovska, New Bulgarian University and Barcelona Medical University. That system also performs educational functions in New Bulgarian University - it is a model for courses in medical informatics and data bases. We use it to present to the students a structural approach in elaborating an Information system for a concrete disease (fig.4).

The screenshot shows a web-based form titled "НАПРАВЕНИЕ ЗА ХОСПИТАЛИЗАЦИЯ" (Referral for Hospitalization). It contains various input fields for patient information, including name, address, and medical history. There are also checkboxes for "срочен" (urgent) and "планов" (planned) admission, and a section for "ИЗПРАЩА СЕ ЗА ПРИЕМ" (Referral for admission).

Figure 3. HIS Svogiq

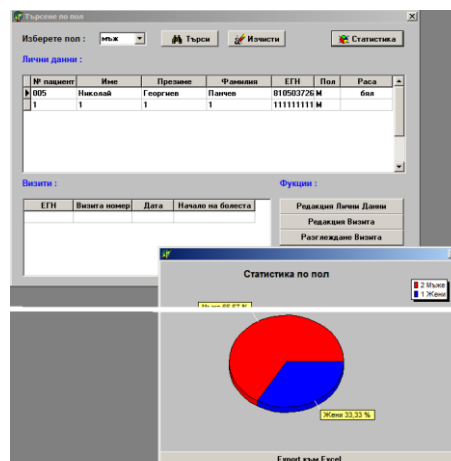


Figure 4. MIS Imunolog

One of the fundamental initiatives of the software is to localize the main predispositions for this disease based on the statistic data from Bulgarian patients for 40 years period, the relationship between treatment and following manifestations of the disease, sequence of results from a concrete therapy and other systems reactions and adaptation.

Imunilog works within LAN and Internet, exports to Word and Excel, checks-up for correct data input, generates statistics with charts and performs authorized entrance through username, password and digital signature, with different access levels.

Teleconsult – since 2008.

Telemeconsult is a multilanguage development, which works within LAN and Internet, exports data to Word and Excel, checks-up for correct data input, generates statistics with charts. The entrance is

authorized through username, password and digital signature, with different access levels It has and mail-client solution, sound and visual notification when receiving information. Teleconsult allows attachment of different format files and automatic check-up for updates. Each record in the system is secured by the digital signature of the medical specialist (fig.5).

It is organized as follows: Main software desktop solution, divided according to the operational level into three main parts– three different management modules that are developed according to the requirements and necessary functions for each participant in the telemedical process. Audio and video streaming through specialized software; Video communication through newly developed application with individual virtual rooms, locked and password protected meetings Introduced and working into 2

hospitals steadily. Generated and performed over 130 telconsultations.

The solution works within LAN and Internet, checks-up for correct data input, different statistics with charts, entrance is organized through username and password. "Dental office" is introduced into 2 separated

dental practices. The dental specialists show satisfaction about the easiness of work with interface; in finding information about previous treatments, stored digital X-ray images. The separated systems have over 150 patients entered each (fig.6).

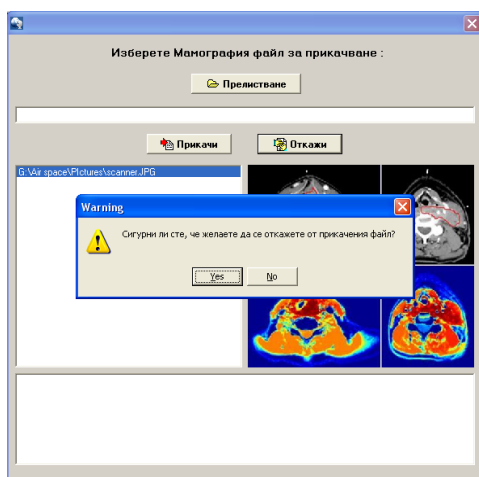


Figure 5. Teleconsult

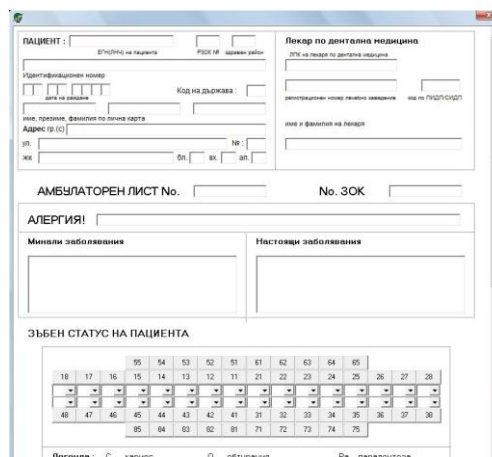


Figure 6. Dental office

Dental office – since 2008.

Border telemedicine solution – since 2009

This solution main idea was to develop a network for the provision of continuity of care telemedical and telehealth services between Greece and Bulgaria which would: (1) be based on the Internet and 3rd/4th generation GSM services; (2) handle the medical records of citizens of both countries, (3) allow the patients themselves or those responsible for their care to enter data or to utilize for this purpose electronic devices that can do this task automatically (e.g., glucose measuring devices, portable ECG machines, spirometry devices etc); (4) permit the treating physician to continuously monitor his patient's progress from a distance; (5) permit the diffusion and dissemination (to specific target groups) of health related information (e.g., diabetes info); (6) use smart card technology to fortify the security of data contained in the patients' records and (7) provide tele-education for the medical and paramedical personnel involved in the project. It was planned to serve at least 15000 patients from both border sides. Up to the current moment the project is approved, but because of financial deficit of our Financial ministry is stopped.

It works within LAN and Internet, exports to Word and Excel, automatic checks-up for

correct data input and updates, generates statistics with charts; attachment of different format files and poses an authorized entrance through username and password, with different access levels. The system proposes mail client service and sound and visual notification when receiving information.

AntiOxi DB – since 2009. AntiOxi DB is a vitamin database, which works within LAN and Internet, exports to Word and Excel, checks-up for correct data input; allows image attachments with authorized entrance through username and password, with different access levels. It is developed on the base of 2 modules – administrative and client, connected to one database, and aims to introduce all the vitamins with their particular characteristics, organic matter, and where the doctor and / or patient specific nutrient found in specialized statistically selected list of most commonly used foods (fig.8).

This representative is Vitamin E, used for example in the presentation features of the database. When choosing a certain micronutrients are transferred to the detailed characteristics, including chemical formula, and the biological significance of vitamin E. The vitamin also is presented as a micronutrient in over 100 preliminary selected foods.

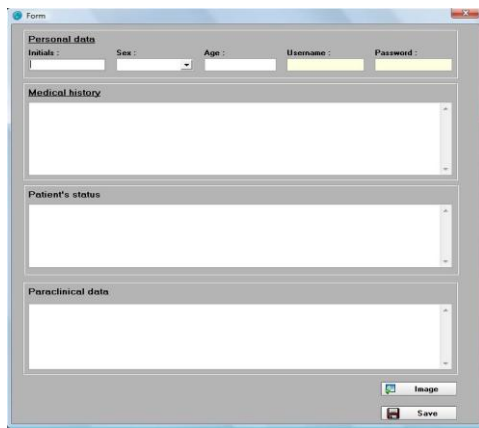


Figure 7. Border telemedicine solution

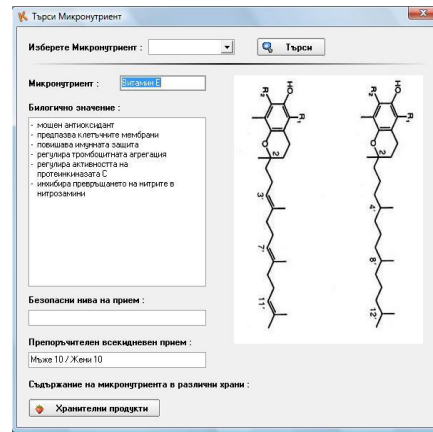


Figure 8. AntiOxi DB

OG Soft – since 2009.

OGSoft is a software solution for obstetrics and gynecology practice, which works within LAN and Internet, exports to Word and Excel, checks-up for correct data input, generates statistics with charts and has authorized entrance through username and password, with different access levels (fig.9).

The record consists of 5 main screens, namely - Administrative and passport data of patients, Medical history, First, Second and Third trimester.

Administrative data are presented with standard parameters for patient information - name, ID number, phone, age, address, doctor and facility, and specialized information - previous births, marital status, insurance status and employer.

OG Soft is introduced into 3 separated gynecology cabinets and up to the current moment has over 120 pregnant women entered. The users describe that unification of the whole patient's data in a digital form,

especially concerning pregnant women, is absolute advantage. Scanned and uploaded images from ultrasound, lab results, and data from regular visits allow the medical specialists to control and track the pregnant women and child status much easier and better.

Phospholipids syndrome – since 2009.

The presented software solution is designed specially for the needs of Immunological laboratory in Sofia (fig.10). It works within LAN and Internet, exports to Word and Excel, checks-up for correct data input, generates statistics with charts and ensures authorized entrance through username and password, with different access levels. It is retrospective database for patients, suffering from anti-phospholipids syndrome, which aimed to collect and organize all the paper version data from the laboratory. We have entered over 100 patients and now together with medical specialists are developing the statistical approach and sections.

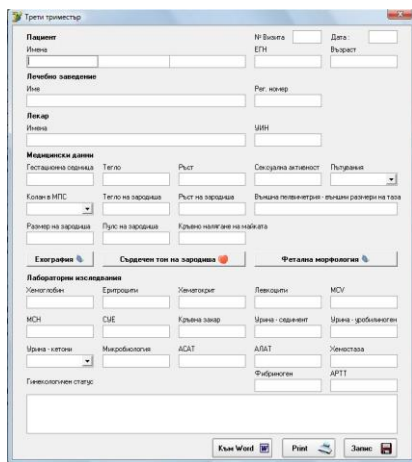


Figure 9. OG Soft

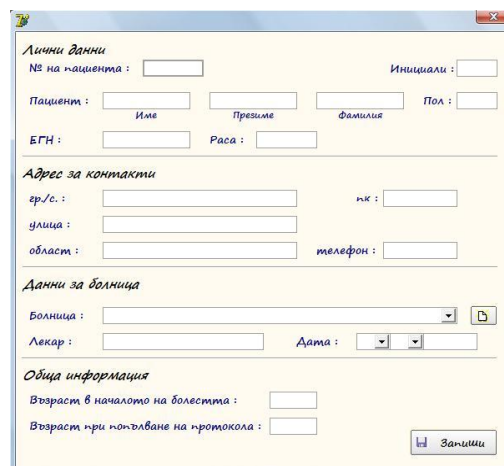


Figure 10. Phospholipids syndrome

*HemaSoft* – since 2011.

HemaSoft is a specialized Information system for Transfusion Hematological Laboratory. It works within LAN and Internet, exports to Word and Excel, checks-up for correct data input, generates statistics with charts and opportunity for image attachments. The software screens are absolutely identical to the paper version of documents and in full consideration with Bulgarian laws (fig.11).

HemaSoft allows digitalisation of records of deferred/accepted donors and patients, search on destroyed and expired blood. It manages the complete inventory of blood units, provides blood group typing and confirmation, captures and maintains donor profile types, provides software support from installation and training to the implementation of system. It has three types of management – management of patient records, management of laboratory and transfusion management. The system is designed specially for one laboratory; it is new development, which is just introduced into the lab. Nowadays, the laboratories in Bulgarian hospitals are still working with more than 10 different types of paper journals and paper records. With this solution, the extremely important blood specifications and information are organized and stored in user-friendly way, which assists the doctor.

Pharmasoft – since 2011.

Pharmasoft is a software solution in the pharmaceutical domain, which performs within LAN and Internet, exports to Word and

Excel, checks-up for correct data input, with provided authorized entrance through username and password. This newly developed solution is introduced into one estate pharmacy. The pharmacist approves the solution, because it generates different sections and statistics - most searched and sold drugs per day/week/month; checks for drug availability and quantity; improves availability of information and reporting, provides an audit trail of actions and activities; ensures transparency, enhances accountability, improves communication and enforces business rules and processes.

e-Ophthalmology – since 2011.

This medical information system with telemedical functions is specialized for the needs of ophthalmic cabinet, and considering that, it differs from the already developed information systems as a unique software product in Bulgaria (fig.12).

It works within LAN and Internet, exports to Word and Excel; checks-up for correct data input; the entrance is authorized through username and password. It has also availability for image attachments.

The interface is simple and intuitive, which eases the user adoption fears and dramatically cuts training time. The system performs fast, efficient access to a wealth of patient information and diagnostic test results, automatically imports directly from capable diagnostic test equipment and optimizes patient flow using workflow conscious layouts, patient tracking, auto-coding, and task assignment features.



Figure 11. HemaSoft

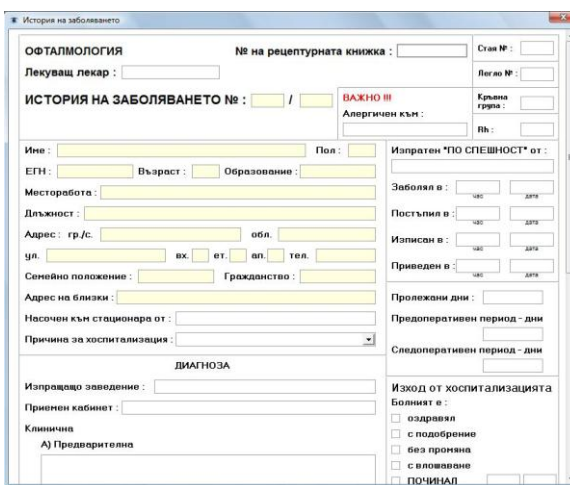


Figure 12. e-Ophthalmology

Future plans.

TelerehabSoft – 2011.

TelerehabSoft is a software model for education and therapeutic treatment of children with autism and other mental disorders. It contains animations, voice commands, and stimulation through different animations, randomized pictures and questions. It is planned to be multilingual solution – English, Norwegian and etc. It is going to be used in medical centers for treatment and rehabilitation of children from distance. Telerehabilitation is the delivery of rehabilitation services over telecommunication networks and the internet. Most types of services fall into two categories: clinical assessment (the patient's functional abilities in his or her environment),

and clinical therapy. Telerehabilitation can deliver therapy to people who cannot travel to a clinic because the patient has a disability or because of travel time. It also allows experts in rehabilitation to engage in a clinical consultation at a distance. The most commonly used modalities are via webcams, videoconferencing, phone lines, videophones and web pages containing rich Internet applications. The first rich internet applications for neuropsychological rehabilitation (cognitive rehabilitation) of cognitive impairment (from many etiologies) were in 2001. Our project idea is to collect medical data from childrens experience with the software, to generate statistics and to assist medical doctors in their treatment and diagnostic schemes.

### Conclusions

For the Bulgarian medical society this is the first specific portfolio description for the experience of software developments within 7 years period. Actually, there is no comprehensive information about patients in the web media in Bulgarian language – treatment schemes, new methods, how to get used to this disorder, what are the chances, where to find expert help.

Our purpose is to ensure statistical background on the one hand for researching and on the other – complete information for the population.

The advances in medical care, genetic tests and development of software database

for precise statistics and research would make possible to cure and even to make preventions, based on e-health solutions.

For 6 years period can be clearly defined that the requirements and technical specifications have rapidly grown up, which shows that the medical experts have become more enthusiastic in application of IS in their medical practice. Even more, there are new requirements from the users, to add video communication, video clips in the attachment formats and etc., which will optimize treatment, diagnostic and curing plans.

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