Electronic health system – development and implementation into the health system of the Republic of Serbia

Elektronski zdravstveni sistem – razvoj i uvođenje u zdravstveni sistem Republike Srbije

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Introduction

Since 1950 information technology has had the potential to impact upon many aspects of the health sector. The ability of communities to access health services is influenced by wider information and communication processes, mediated by information and communication technology (ICT) [1].

Computer technology has been used in healthcare since 1960, but changing and going through various stages [2]:

– First experiments with the new technology in the health system were recorded in sixties. It was the first time to develop computerized tomography, as a new diagnostic method, by combining medical equipment with computers. At that time was one of the first Clinically-oriented Hospital Computer Information Systems (HCISs) established. It was Technicon Medical Information System (TMIS). TMIS development began in 1965 as a collaborative project between Lockheed and EI Camino Hospital in California [3].

– In the 70's the number of hospital information systems was growing rapidly. The first approach to their implementation was in favor of a centralized, integrated, closed system, and relied on large, central (mainframe computer) computers.

– The 80's, in addition to further development and expansion of the concept of information systems in medicine, were characterized by the development of two disciplines: artificial intelligence (divided into expert systems, pattern recognition and neural networks) and methods of information synthesis (with the aspects of a general overview and association data).

– The 90's were marked by the process of integration: integrating the health information system, forming an integrated database of medical and administrative data or knowledge, and communication: a complete communication in the healthcare system and communication of that system with other systems.

– Medical informatics is now accepted as a basic medical science. Analogy with other basic sciences is recognized in the use of previous experience and results to structuring and coding of objective and subjective medical findings, which makes them suitable for analysis, integration and reuse.

Application of ICTs in health care tends to expand the focus of resource management to knowledge management and processes management.

In Europe, integration of information and communication technologies in health care was performed to provide better health services for patients, by achieving mobility of people and providing the opportunity to control and analyse the entire healthcare system in terms of economy and quality, and thus to the possibility of managing large health systems. This brief review shows that there is no common nor unique approach to this area. Depending on its socio-economic opportunities, each country, makes effort to find out the best way to solve problems of management and control of the health system.

The potential of ICT applied to healthcare system can be used to improve health services rendered to citizens, but also to health professionals in order to have safer, higher quality, more rational and better health care. ICTs are a basis for the development of health information system.

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Health information system has a number of features, such as scheduling of examinations, patient registration, record keeping of medical personnel services, electronic patient records, diagnostics, laboratory, pharmacy, statistical processing of collected data, management support.

Electronic health system

The so-called electronic health system (e-health) was created by the application of contemporary ICT, which has fundamentally changed medical practice, enabling a significant increase in quality and efficiency of health service through a more rational and effective use of available resources. The term "e-health" encompasses a wide spectrum of medical services used with the help of information technologies.

E-health is usually defined as the Internet and information technologies use in healthcare system, which improves access, efficiency, effectiveness and quality of medical business processes with the participation of relevant entities (healthcare facilities, medical staff, patients, insurance companies, state) and the aim of improving health condition of a patient [4].

E-health radically changes access to health information, as it allows an easy and quick access to those data, regardless of a user location, taking into account authorization of health professionals who access them. E-health includes: telecommunications systems between healthcare institutions and patients and doctors, and storage electronic medical records collection, processing, keeping electronic medical records, access to healthcare system through mobile communications (a village doctor, ambulance, etc.).

In an E-health system there are the following essential services [4]:

– An electronic medical record is the first step towards more efficient and higher quality healthcare system, and it contains valuable information for all actors in the system. Electronic medical records are usually a computerized legal medical record created in an organization that delivers care, such as hospital and doctor's surgery. An electronic medical record tends to be a part of a local stand-alone health information system that allows storage, retrieval and manipulation of records.

– Telemedicine is a service that involves all types of physical and psychological measurements that do not require a patient to visit a specialist. Owing to this service, a patient does not have to travel often, and a doctor can cover a wider geographical area.

– Evidence-based medicine is a service including a system that contains information about the current state of a patient. A doctor can check whether the diagnosis coincides with the current scientific research achievement. The advantage of this service is that data are always up-to-date.

– Citizen-oriented information provision is a service that enables both physicians and patients to be informed about the latest medical knowledge.

– Specialist-oriented information provision is a service that allows physicians to follow the most recent editions of medical journals, best experience in practice and epidemiological monitoring.

– A virtual healthcare team is a virtual service representing a team of doctors who cooperate with each other and provide necessary information to patients via e-mail (web portals, e-mail, forums).

The main benefits derived from the usage of electronic health system are the following: efficiency in rendering health care – the introduction of electronic communication model between doctors and patients; health care costs reduction; the employee productivity growth; providing the right information in the real time by using the internet; maintenance of medical services quality by using electronic knowledge management.

Due to electronic healthcare system, the resources are used in a more rational way by analyzing the current situation and immediate needs for medical supplies and the usage of hospital capacities.

Electronic healthcare system enables the generation of various reports using all electronic health care records. The analysis of these reports is a way to strategic planning and creating an accurate demographic and health condition of the nation.

Knowledge management system has been implemented with the aim of spreading the expertise of doctors in electronic healthcare system. Thus competence is being improved, which contributes to increasing the total effectiveness and efficiency of healthcare institutions.

Due to the sensitivity of data content in electronic health system, a special attention must be paid to their safety, i.e. protection of integrity, confidentiality and availability of information. The security mechanisms in electronic health system are [5]: authentication, which makes it possible to reliably identify a user via electronic smart card; use of digital signature; protection of confidential data in the system, which is achieved by using cryptographic methods, and access control that provides a controlled access to resources.

Electronic healthcare documentation

One of the basic components is the electronic healthcare documentation (EHD) system, which is based on an electronic healthcare documentation of a particular healthcare consumer unified through a singular identifier throughout a complete healthcare system. The EHD system provides data on basic processes in the healthcare system regarding health care of a particular consumer.

A new approach in conducting business processes in the health information system is the existence of a unified electronic healthcare documentation. The main feature of electronic healthcare documentation is patient orientation. This means that the exchange of information about a patient health is done via the electronic healthcare documentation, thus improving health service and reducing operating costs.

The electronic healthcare documentation incorporates information collected during the entire life of a patient and from various institutions that render health services. This information is available regardless geographical and temporal distance and protected by security mechanisms. This means

that every user of the EHD system controls the access to his/her data, and defines which data could be available to whom.

Figure 1 shows a correlation of the electronic healthcare documentation that is available to all users regardless location. Access to information is strictly controlled using standards for privacy and security of information, modern technological solutions and legal rules.
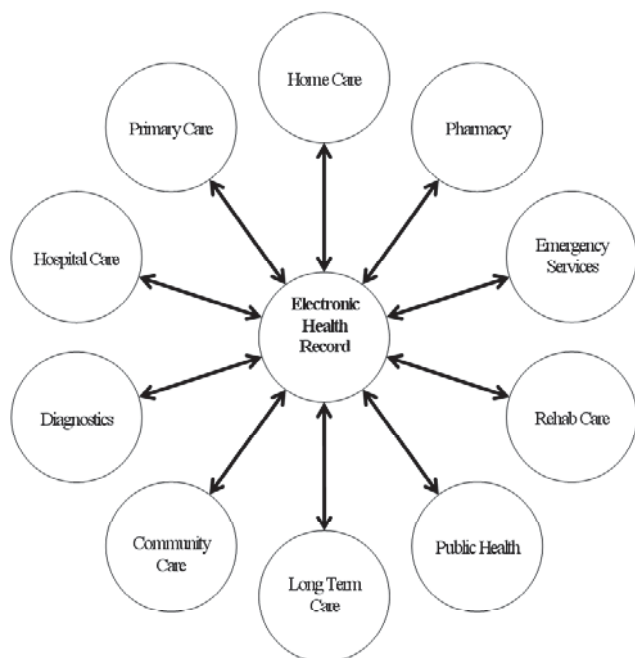

Fig. 1 – Connected electronic healthcare documentation [6]

Electronic healthcare documentation is an information which has been collected and exchanged during regular check-ups by doctors, pharmacists, in hospitals and insurance companies. This means that: all this information will be stored in one centralized place; all healthcare facilities must adopt electronic information systems and use common standards with regard to data in order to enable integration; healthcare organizations and doctors specialists who perform private practice should see themselves as "guardians" of patients' health information, not as the owners of business information; healthcare organizations and other participants in generating EHD have to follow and adopt the best practice to ensure privacy and security of personal health information.

Electronic medical documentation

It is necessary to distinguish between electronic healthcare documentation and electronic medical documentation (EMD). Electronic medical documentation is a software platform for managing detailed medical information collected during a patient's stay in a medical institution. It usually contains a medical history, doctor notes and laboratory and X-ray results, and as a rule is owned by a physician and it is limited to information collected by one doctor and one hospital. An EMD rarely contains information provided by a patient. An EMD is not used by all physicians,

and often when a patient changes a doctor or moves to a new surroundings, personal health information does not move with him/her [7].

Electronic patient records

Electronic patient records (EPR), and/or their idealization Electronic Health Records (EHR) are actually the outcome from which both professions (medicine and computer science) build their view on the common goal: building a new system of health services in which the application of technology for knowledge dissemination helps all health professionals to provide personalized service to every patient in accordance with the latest medical standards resulting from the most recent knowledge, and that is knowledge [8].

With the help of the Internet and the set standards of communication between participants in healthcare system, electronic records enable a patient to get a complete insight into the process of solving his/her health problems in electronic form from any geographical location and at any time. Thus, a patient becomes an active participant in his/her treatment not only as a patient, but also as a person who is entitled to make decisions regarding his/her treatment: to choose where to be treated and who by, what level of service quality he/she wants, to seek review of medical expert opinion, etc.

On the other hand, a doctor has a complete overview of medical history, any results, previous diagnosis and prescribed treatment for every patient. It allows him/her to gain a full picture of a patient's health status and to help him/her in the best and most effective way.

Due to multimedia content transfer (digitized images, medical images and documents) *via* the Internet, the conditions for verification of diagnosis by several doctors in different locations have been created, thus reducing the probability of errors in the diagnosing process.

When making diagnosis, doctors have at their disposal the existing diagnoses of patients made earlier by other doctors. In that way, not only a doctor, who improves his/her expertise benefits, but also a patient, who will have the access to consultative opinion of doctors.

The existence of electronic medical records allows medical teams to have an easier access to information, greater interactivity in work through the possibility of telemedicine consultations, and thus the opportunity to solve more cases.

Drugs manipulation is reduced and the possibility of medical errors avoided by the management of electronic records of diagnoses and prescribed medicines. Also, by electronic medical records electronic healthcare system prevents incompatible drugs prescription or drugs that patients are allergic to.

Writing and control of referrals to laboratory analyses are common problem in medical practice. Referrals are electronically sent to a laboratory by the usage of electronic medical records, with the indicated type of analyses and diagnoses, and after processing analysis findings are returned to the doctor. The plan is to enable the same electronic functionality for X-rays, ECG recordings and ultrasound examinations.

A healthcare institution has tremendous benefits of data analysis from electronic medical records of treated patients. Thus, a healthcare institution gets a complete insight into all processes of healthcare personnel work. Patient electronic medical records give the opportunity to accurately detect possible disorders of business process in healthcare system.

So, the essence of the treatment process remains the same, but in an easier way, more efficient, less hazardous to a patient and it has a great impact on shortening the time for diagnosis. According to the same principle, significant savings and benefits in informatics connections between healthcare institutions at different levels of health care are made, mainly due to the ability to have the unique information about each patient.

Electronic health smart card

Healthcare organizations worldwide are implementing smart health cards supporting a wide variety of features and applications.

Electronic health smart card is a basis of successful e-health system functioning. Smart health cards can improve security and privacy of information about a patient, provide a secure carrier for portable medical records, reduce health care fraud, support new processes for portable medical records, allow secure access to emergency medical information, enable compliance with government initiatives and mandates, and provide a platform for implementing other applications as needed by healthcare organizations [9]. There are several types of health cards, but the following three types are the most important [10]: patient data card; health professional card and health insurance card.

Patient data card (PDC) is a mobile patient data carrier. It contains information about a patient that is essential for his/her treatment. Typical data on card chips are: the identity of a patient, information about insurance, emergency data, medical history and electronic prescriptions [10].

For patients mobility means that they have complete and accurate health information at any time. Their critical data are always available when it comes to emergencies. Under normal circumstances, the usage of the card provides data finding and establishes an appropriate treatment for a patient. This prevents excessive medical tests and examinations, and therefore results in urgency and efficiency in solving critical health problems of a patient [11]. For health professionals, the advantage of data mobility is the fact that they work with verified and reliable health information on patients. It is easier to find the best treatment and avoid risk of prescribing potentially dangerous drug combinations with these data.

Typical data on a card are: patient's personal data (name, address, date of birth, telephone number), a digital certificate issued by an appropriate certification body, patient insurance (insurance, social security number, expiry date), a small medical database of a patient (information about diseases, treatment, blood type, allergies, diabetes), prescription data (medication, dosage, date of an issued prescription), an electronic wallet for potential, small amounts of payment in healthcare system, and a patient's personal identification

number (PIN) and cryptographic keys for mutual authentication between the card and Smart Card reader [10].

Health professional card (HPC) is an authorized access card which a health professional has. It gives him/her the right to read or write data in fields on patient data card, and it also carries a digital certificate and appropriate cryptographic keys for secure communication. Privacy and data security are guaranteed to patients in accordance with the rules of access, which prevent unauthorized access to their stored medical data [10].

For health professionals, HPC provides a quick and efficient information exchange between health professionals and other users in electronic health system.

Typical data on the card are: identification data of health professionals (name, address, phone number), a digital certificate, individual access rights for reading and/or writing patient's data, PIN to access the card, cryptographic keys for mutual authentication between the card and smart card reader, asymmetric keys to perform digital signature [10].

Health insurance card (HIC) is an ID card with an administrative function. It contains details of the insured, the insurance company ID and information about insurance model.

In some systems, PDC and HIC cards could be integrated into a single PDC card. In this way the administrative procedure for admission to the hospital, i.e. doctors' office is much easier for patients. HIC card increases patient satisfaction and reduces paperwork. Health data of the insured are processed more quickly and accurately. A health professional gets fast, precise, easy and cost-effective data management. This means less paperwork, reduction of transaction costs and more effective payment. Insurance companies benefit because electronic data processing enables data on claims to be processed without error.

Typical data on an insurance card are patient's insurance (insurance, social security number, expiry date), ID insurance, and insurance coverage [10].

Cost-benefit analysis of electronic healthcare system

Cost-benefit analysis in health care is the analysis of resource costs of health care in relation to possible benefits. This analysis is useful and necessary in establishing priorities when choosing between limited resources and desired results.

Costs related to electronic healthcare system

There are two categories of costs related to electronic healthcare system: system costs and induced costs. System costs are the costs of purchasing software and hardware, training, implementation, ongoing maintenance and support. Induced costs are those costs involved in the transition of establishing an electronic system, such as a temporary decrease in service productivity after its implementation.

Software costs are related to the initial purchase of software, with annual maintenance and support fees. The service price includes design costs and system development, interface to existing business systems (planning, laboratory) and periodic updates.

Benefits related to electronic healthcare system

There are much more benefits than costs related to the transition to electronic medical records. The main advantage of introducing electronic medical records is a way of keeping patients' records. Paper documents can be lost, and electronic medical records are stored on a network that is available regardless of location access.

The other benefits of electronic healthcare system implementation are: electronic healthcare system resolves the following issues: paper documents may be incomplete, illegible, and sometimes impossible to find. It is difficult to observe the chronology of patient's disease or to reach the desired information in an efficient way; in electronic systems it is possible to provide an integrated support for a wide range of activities: decision support, monitoring, electronic drugs prescribing, electronic recommendations, processing and results presentation. For instance, the investment in picture archiving and communication system (PACS) is repaid in 1–2 years, which means that from the third year onwards, this system makes great savings in the social security budget; data and information on epidemiological monitoring and control of disease can be easily analyzed, investigated and controlled in electronic systems, and support for continuous medical education.

Obstacles in electronic healthcare system implementation

Electronic healthcare system implementation is hindered due to: technical issues (uncertain quality, functionality, usage, lack of integration with other applications); financial issues (initial costs of hardware and software, maintenance, upgrades, replacement, investment reimbursement); resource issues, training and retraining; resistance from potential users, due to the changes in working practice; and certification, security, ethics, privacy and confidentiality.

Conclusion of cost-benefit analysis of electronic healthcare systems

This analysis shows that net financial analysis of electronic healthcare system is positive in a wide range of assumptions. The main advantage is the reduction of administration costs, the necessary resources and various operational errors.

The described cost-benefit analysis is based on data published in foreign literature. The costs of electronic healthcare system can always be even higher, depending on system complexity. The described costs and benefits are directed towards primary healthcare services.

Not all the advantages of electronic healthcare system implementation can be measured in financial terms. The other benefits include the improved quality of health care, reduced medical errors, as well as better information access.

Cost-benefit analysis is only a part of a complete analysis of the effects of electronic healthcare system implementation. Electronic healthcare system is the key component of the strategic objectives of the Ministry of Health to establish an impeccable care for primary, secondary and tertiary health care.

Electronic healthcare system implementation can lead to positive financial profits in relation to investment in health care organization. The implementation of electronic healthcare systems is a great way to reduce the costs of health organization. Studies have shown that this practice pays off over time, and that it goes towards creating a more efficient healthcare system.

Development of e-health system in the Republic of Serbia

When establishing electronic healthcare system in the Republic of Serbia it all started from the real situation in this area in the country, with a vision of the possible directions in the future.

Generally, healthcare information system in Serbia is mainly old-fashioned and in paper form. There is no coordination and information and communication technologies are rarely implemented.

The objectives of establishing electronic healthcare system in the Republic of Serbia are the following: to modernize healthcare system by applying the appropriate information- communication and telemedicine technologies; to simplify the use of ICT to be available to all participants in the electronic healthcare system, and on the other hand motivate healthcare workers to use computers in order to improve work efficiency; to promote electronic healthcare system as a system of reliable, timely, high quality and available health care which uses modern ICT as its basis; electronic healthcare system can improve monitoring of spreading easily transmitted diseases and warn users about that; to emphasize the importance of continuous medical training, education and research by using ICT; electronic healthcare system will facilitate access to new knowledge in science, profession and content of local concern in order to encourage research in the field of health care and prevention programmes; to encourage a positive attitude of people towards ICT by offering high quality content about healthy lifestyle and disease prevention on an appropriate Internet portal; to respect and protect citizens rights to privacy and security of their health data; to implement international standards in the exchange of health data; and to strengthen and expand initiatives for rendering medical and humanitarian aid in case of disasters or emergency situations based on ICT.

The strategy for the development of e-health system in the Republic of Serbia includes the development of a centralized model of collecting and managing data, which means that the information from all layers and organizations are centralized, standardized and ready for analytical processing at any time.

Taking into account the specificities of the healthcare system in Serbia, Figure 2 shows the main components that make up the "building blocks" of e-health.

Their scope and contents are organizational aspects of Serbian healthcare system, not technological resources. Technology must be used in accordance with present organization, but it also has to be independent and not to disturb
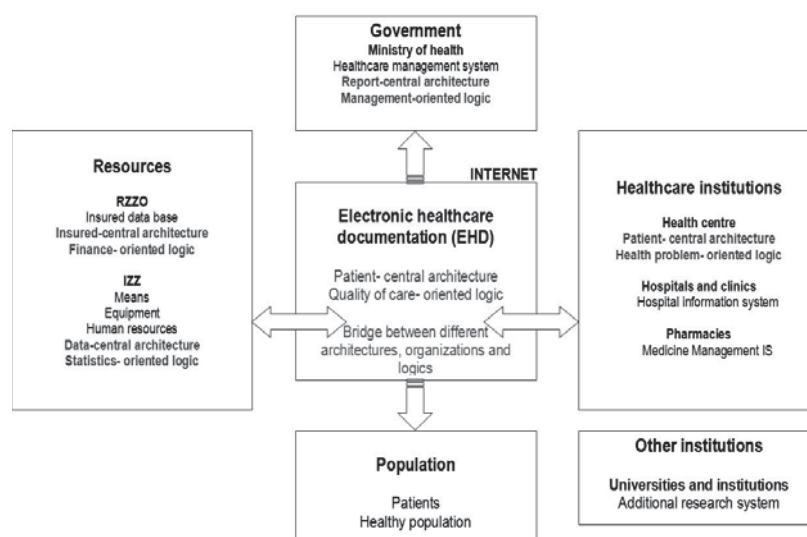
Fig. 2 – Electronic healthcare documentation inside the healthcare system in Serbia[13]

organizational changes, i.e. it has to sustain and support any organizational changes with minimal additional costs.

The development strategy of the integrated e-health system in Belgrade is in compliance with the principles and standards of EU and represents an integral part of the e-health system of the Republic of Serbia. The main goals are to make a comprehensive and integrated e-health system that will enable collection and management of health care, clinical, administrative, and financial information in Belgrade, in a technologically adequate way.

Table 1 shows main participants in the healthcare system, their present roles in the system and improvements to be achieved in the Republic of Serbia [14].

In August 2002, the Ministry of Health of the Republic of Serbia established the International Cooperation and Project Coordination Department. Cooperation with the World Bank and European Union resulted in initiation of several projects. A couple of bilateral projects has been realized with donation support from different countries, European Investment Bank, organizations such as ECHO, UNDP, UNICEF, International Red Cross, EPOS, Global Fund, USAID etc [15].

Since 2002, foreign partners have contributed to making several documents that served as base for the healthcare system reform and those documents are [14]: Policy of Healthcare Protection in Serbia, dated 2002; Vision of Healthcare Protection System in Serbia, also from 2002, and

Table 1

Main participants in the healthcare system

Participant	Role in the healthcare system	Informatics role	Improvements to be achieved
Patient	Healthcare consumer	Stores and transfers healthcare documentation from one place to another	Saving time and energy, Faster and better service, Reduced margin for errors.
Healthcare employee	Provides healthcare services	Reads, transcribes, and checks particular healthcare documentation. Makes notes of important events prescribed by the law (diagnostics and services)	Saving time in prescribing, Reduced margin for errors, More detailed insight into treatment of his/her patients done by other doctors, Automatic markup of important information in the background, Information accessibility and continuous education, Organized provision of healthcare services.
Healthcare institution	Provision of healthcare organization and services	Processes particular data, Submits single and aggregated data to health care office and healthcare insurance fund.	Automated processing of particular results, Electronic reporting to health care office and healthcare insurance fund, Realistic picture of situation for managing purposes.
Health insurance fund	Healthcare system financing and planning	Receives and processes data on provided services submitted by healthcare institutions.	Receiving more accurate data
Healthcare protection office	Organizing and planning healthcare services	Receives and processes data submitted by healthcare institutions	Receiving more accurate data
Ministry of health	Legislation of healthcare services	Interprets reports submitted by health care office and healthcare insurance fund	Making decisions based on more accurate data

Strategic Reform of Healthcare System until the year 2015, promoted in the publication "Better Healthcare for Everybody in the Third Millennium" (2004).

The project "Development of the Healthcare Information System for Basic Healthcare and Pharmaceutical Services" started on November 15, 2004. The main goal of this project is the implementation of Electronic Healthcare Documentation (interconnected EHD) into the Serbian Healthcare Information System (HIS).

Strategic goals of the project are [15]: to contribute to raising the level of responsibility in the Serbian healthcare system, to ease the transition process towards evidence-based healthcare system for the purpose of expenditure control and avoidance of repetition in the process of providing basic healthcare services and drug prescriptions, to establish a national healthcare information system based on e-health principles and adequate standards of medical informatics.

Specific operational goals of the project are [15]: to develop an electronic healthcare information system, as the essence of national healthcare information system, based on European and other international standards on EHD, localized and adopted on the national level, to develop and implement a national center for interconnected EHD in Belgrade and four regional centers for interconnected EHD in Belgrade, Novi Sad, Nis and Kragujevac through the pilot implementation in Pancevo; these centers will ensure data exchange on the patient level as well as generation and dissemination of information through adequate infrastructure, to recommend adequate legislative measures necessary for implementation and proper functioning of the system, with an accent on data privacy, protection and safety, in compliance with European legislative regulations, and to recommend an organizational and institutional frame which will ensure sustainability and enable further expansion of the interconnected EHD system.

Besides the Healthcare Center Savski Venac, few other centers have developed the system, such as Healthcare Center Vranje, Healthcare Center Mladenovac, Healthcare Center Zemun, Clinical Center of Serbia, Clinical Center Kraljevo, Healthcare Center Zrenjanin, Healthcare Center Uzice, etc. Based on previous experience, there emerges the necessity of reaching a consensus, a widely accepted solution on electronic healthcare record contents and development of technical standards that will make these records easily accessible and safe [15].

The results of internal researches in Healthcare Center Savski Venac showed that a large amount of effective working hours is being spent on filling in different kinds of forms, daily and monthly reports (about 30% by doctors and even up to 70% of working hours by nurses). According to the new system, right after the check-in moment on the reception desk, patient's data are being forwarded into the doctor's computer and the doctor is able to see the daily list and examination schedule at every moment. A new approach enabled by the information system is not based only on computer use, but also on the doctor-nurse teams formed according to the latest EU recommendations. For instance, while the doctor is performing medical examination, a nurse enters general data, and while the doctor is prescribing therapy or further specialist examinations, the nurse prepares patient for further examinations. By using the same computer simultaneously, required data are entered only once by one of the team members and on the same location. The stored data are afterwards easily accessible for the statistics and accounting departments and can be easily forwarded to higher instances [16].

This kind of approach reduces waiting time for the patients and improves quality of healthcare services provided. Implementation of the electronic healthcare record does not change examination duration, but does change the effective period of time that the doctor can dedicate to his patient.

Centralized model of data collection and management is being developed and will enable organized and standardized inflow of information from all organizations, ready for analytical processing at any time. This model does not exclude local storage and processing of data, but enables simultaneous transparent availability, both on the centralized and local level. This is achieved by integration and collection of data in real time through the centralized data repository [15].

The development of e-health in Belgrade is currently directed mainly towards development of necessary infrastructure, but implementation of certain applications is expected shortly, such as electronic drug prescription, permanent medical summary, electronic record etc. There are initiatives in progress for the acquisition of necessary equipment for institutions, development of local computer networks and connection with dislocated clinics and computer connection between pharmacies and healthcare centers. Intensive efforts are being made in Belgrade Pharmacy to further develop the present network and create conditions for faster drug disburse, and there are several local computer networks realized with funds from National Investment Plan as well as the complete communication infrastructure of Clinical Center "Dragiša Misović" [15].

Several other projects in different healthcare institutions are being realized in cooperation with the European Agency for Reconstruction (EAR), Health Insurance Fund and Ministry of Health.

In order to speed up the development of e-health in Belgrade and Serbia, it is necessary to ensure extraordinary cooperation between all participants in the project, because the essence of the following reforms in the healthcare system is closely connected to informatics systems.

Figure 3 shows the network infrastructure in Serbia, which includes four regional key-points (Novi Sad, Belgrade, Kragujevac, Nis) and the National Key-Point in Belgrade. It should enable the safe exchange of data on the health of patients.

Each of the four regional key-points includes several districts as defined now (there are 25 districts in Serbia without Kosovo). Accordingly, new levels of management in the healthcare system are being defined.

The key-points are connected in a virtual network of the healthcare system through the national network infrastructure. Centers for electronic healthcare documentation are at the key-points of the national network infrastructure of the

healthcare system. These centers are equipped with servers (Internet/Web, Application & Database) and a large database management system.
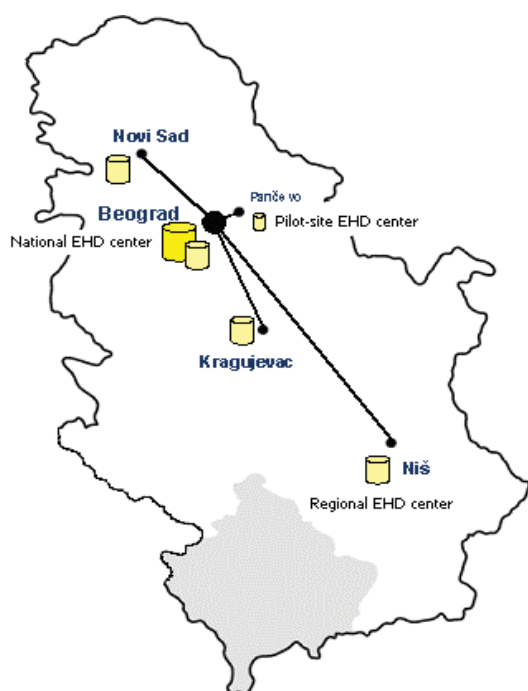

Fig. 3 – Infrastructure of the electronic healthcare documentation (EHD) system network in Serbia

Electronic healthcare system in the Health Center Vranje has been established in the following services: General Medicine Clinic, Pediatrics Clinic, School Clinic, Occupational Medicine Clinic, Women Health Care Clinic. After three months of the pilot project implementation at the Health Center Vranje the following improvements have been noticed in terms of efficiency and cost savings, as shown in Table 2 [17].

In addition to time savings made by patients, medical and administrative staff, the coordination between the Health Center Vranje and Pharmaceutical Institution Vranje is satisfactory, due to the fact that electronic prescriptions patient data are loaded in the pharmacy software for 1 second per prescription (Table 3) [17].

Currently, the Ministry of Defense of the Republic of Serbia is aimed at the development of electronic health system which includes introduction of military electronic health cards, as well as a rapid implementation of certain applications such as electronic drug prescription, durable medical summary, electronic records [18].

The usage of electronic ID cards reduces costs in the Ministry of Defense produced by an inadequate and uneconomical use of available resources – human, material, financial and information. It also increases productivity and data and information safety in information systems.

The card contains two chips – a contact and a contactless [18]. There is an electronic record of data about a card holder in the visual part of the contact chip. The chip has

Table 2

Time of serving patient and data processing in the Health Center Vranje

Serving activities	Time serving	
	Before EHS	Using EHS
Patient time from arrival at the doctor's to departure with the given treatment	24 min	12 min
Time for a doctor necessary to type referral, findings and prescriptions (average)	9 min	2 min
Time for nurses to enter the protocol, write prescriptions, enter accounts for the insured	9 min	2 min
Time used by administrative staff to summarize all reports on a monthly basis	It is not possible to accurately measure	1 min

EHS – Electronic Health System

Table 3

Time of serving patient and data processing in the Pharmaceutical Institution Vranje

Serving activities	Time serving	
	Before EHS	Using EHS
Patient time from arrival to the Pharmaceutical Iinstitution to a prescription issuance	3.5 min	<1 min
Statistical analysis of all prescriptions by services, departments, sectors	It is not possible to accurately measure	1 min

EHS – Electronic Health System

In the pilot project of the Ministry of Health and the Institute for Health Insurance of the Republic of Serbia, the implementation of electronic healthcare system has been made in the Health Center Vranje. Coordination of business processes of the electronic healthcare system implementation project directly depends on three systems, as follows: the Institute for Health Insurance main branch Belgrade, the Institute for Health Insurance branch Vranje and the Health Center Vranje.

such characteristics that it can accept all the other contents needed for record, by using security system to protect those contents from being accessible to unauthorized personnel. In terms of protection, the chip meets the highest standards.

On the body of the card there are the following data: name, identification number, capacity, serial number, personal number of the insured, issuing date and expiry date of the document, whereas the official data such as rank, military

post, place of service, name of unit or institution, which a person with an issued electronic card belongs to, will be filled in the chip [18] (Figure 4).

the Internet access. Doctors increasingly use computer for data storage as well as sending laboratory results to patients via e-mail [23].

Fig. 4 – Electronic health card applied at the Ministry of Defense and the Serbian Armed Forces [18]

The introduction of electronic health cards in healthcare system of the military insured is an integrating factor for the entire future military healthcare information system. Their introduction and application will ensure an organized and synchronized connection of military healthcare facilities. The usage of electronic cards and gradual linking of all healthcare institutions in an internal computer network will enable the creation and safe use of a centralized electronic healthcare documentation. The main characteristics of access to the centralized EHD are patient orientation, the exchange of information about health of patients in order to improve health services and reduce treatment costs [19].

The centralized EHD establishment and electronic health cards implementation will enable the linking of medical data from different sources (electronic patient cards from the Military Medical Academy, military medical centers, pharmacies), forming a complete „health picture" of a patient and providing data about a patient, such as allergies, reactions to certain drugs, contraindications, etc., currently available to a doctor in order to make the process of treatment efficient and effective [19–21].

The use of ICT in the Republic of Serbia vs. the European Union countries

In the Republic of Serbia there is an interest and positive attitude of the population to electronic healthcare system introduction. This attitude stems from the fact that ICT are increasingly used in everyday life activities.

The Statistical Office has done research on ICT usage in the Republic of Serbia in 2010, and it includes the territory of the Republic of Serbia (excluding Kosovo) where it was found that 19.7% of citizens connect to the Internet to get health information [22].

In the EU countries the majority of general practitioners use computers at their work, and more often communicate with their patients electronically – according to a survey released by the European Commission on the use of electronic healthcare system. The data show that 87% of general practitioners use computers, out of which 48% have

The use of ICT in health care has enabled the improvement of health services and shortened waiting time for patients, according to a survey conducted in 27 EU countries and in Norway and Iceland. The member of the European Commission for Information Society and Media Vivianne Reding said: "This research shows that the time has come now for everyone in the health sector to use the electronic services because they can significantly contribute to the service quality rendered to patients throughout Europe" [23].

However, within the EU there are great differences in the use of ICT in healthcare. For instance, in Denmark 91% of general practitioners use the Internet, and in Romania only 5%. Denmark is the country with the best access to the Internet, and about 60% of medical practices use e-mail as an usual way of communicating with their patients, while the EU average is only 4% [23].

Only 6% of physicians on average in the EU issue prescriptions over the Internet, while such practice is present only in 3 countries. A total 97% of doctors in Denmark issue online prescriptions, 81% in Sweden and 71% in the Netherlands. As for telemedicine, which enables doctors to have the remote control of disease development with their patients or monitoring chronic diseases, things are still in their infancy. Such services are offered by only 9% of physicians in Sweden and 3% in the Netherlands and Iceland [23].

In 2005 statistical research was conducted in the EU countries regarding the use of electronic medical records in healthcare institutions. The most advanced in this process is Finland, where 95% of physicians used electronic medical records, and the following were Sweden and the Netherlands. In the same year, by the same criterion, the worst in the European Union were Spain, Greece and finally France (17% of physicians who use electronic medical records) [10].

The presented data show that there was still some maladjustment to electronic healthcare system. Most doctors agree that ICT improves the quality of offered services. As the main reason for not using ICT, doctors state the lack of training and technical support [23].

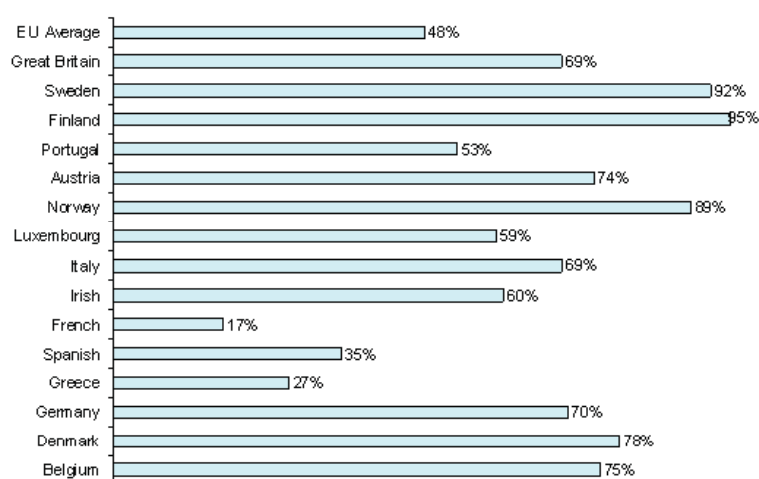Figure 5 shows the percentage of doctors who used electronic medical records in the EU countries in 2005.

Fig. 5 – The percentage of doctors who used electronic medical records in the EU [24]

The results of electronic healthcare system development in the Republic of Serbia so far

The review of e-healthcare system development in the Republic of Serbia in relation to the Development Action Plan until 2015 shows that there have been made significant IT components and laid the foundations for the future integrated health information system of the Republic of Serbia. The following has been done so far [25]: a central database of the insured has been established; the information network from the Directorate of the Institute for Health Insurance of the Republic of Serbia to all branches and offices has been established; the Central Information Service (CIS) in the Republic Institute for Public Health "Batut" has been made with the established health care resource base. CIS is also a portal that will serve health system users. CIS contains information about all 284 healthcare institutions, 124.000 employees and medical equipment; intensive work on training of final users and testing of CIS functionality; four pilot projects in hospitals (Kraljevo, Valjevo, Vranje and Zrenjanin), have been made with whole ICT infrastructure and purchased computer equipment; a variety of professional, medical and demographic data, information on allergies, medical history, laboratory analyses results, data on received treatments, information about scheduled procedures and examinations are clearly structured, which enables an easy and fast access to the entire patient documentation.

The following is planned in the project continuation: the improvement of software for reporting; the improvement of software for laboratories: it is necessary to connect laboratory instruments and information system, so that the results are automatically sent to an information system; the improvement of software for radiology systems: connection of radiology systems and information system – image scanners, X-ray, magnetic resonance; the implementation of information system related to all health centers (158) in the Republic of Serbia.

Project delivery of improved local services (DILS) of the Ministry of Health needs to complete computerization of the health system by 2011 and that during the 2012 achieve connectivity with other departments. The plan is to integrate the whole system by 2015 in order to better and more accessible health care.

Conclusion

The main objectives of the development of health system are building a comprehensive and integrated electronic healthcare system, which will enable the collection and management of all data relevant to a complex healthcare system of the Republic of Serbia with the help of the latest information and communication technologies.

E-health system provides a foundation for a new approach to organizing and carrying out business processes in healthcare system supported by information and communication technologies. The main features of the new approach are orientation to a patient, health care based on evidence, exchange of information about the health of a patient in order to improve health services and reduce costs.

When you begin to implement electronic health system in Serbia, it is assumed that such a system will increase the capacity of collection, storage, copying, transmission, sharing and manipulation of information, perhaps in a way that people do not expect.

Introduced an electronic health system is of a strategic importance because it will mean a simpler procedure for users of healthcare system services, easier and more reliable operation of health professionals at primary, secondary and tertiary level of health care, more efficient control of the status of the insured and more efficient and effective process of treatment.

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