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COMMUNICATION VIA THE WEB AND SMS SERVICES IN THE HEALTHCARE SYSTEM IN THE REPUBLIC OF SERBIA

One of the major problems in healthcare and modern medicine in general, is the collection, processing and use of data collected daily in the form of paper documentation within medical institutions. The introduction of information and communication technology increases the efficiency, productivity and work quality of a health organization, and also gives the opportunity to improve communication between patients and doctors. Possible communication channels are web applications and SMS services. The paper presents the research related to the possibility of using web and SMS services in communication between doctors and patients in the Republic of Serbia.

Keywords: information and communication technology; healthcare; communications; web and SMS services.

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ЗВ'ЯЗОК ЧЕРЕЗ ІНТЕРНЕТ І SMS В СИСТЕМІ ОХОРОНИ ЗДОРОВ'Я РЕСПУБЛІКИ СЕРБІЯ

У статті визначено, що однією з основних проблем охорони здоров'я і сучасної медицини в цілому є збір, обробка і використання даних, які збираються щодня у вигляді паперової документації в медичних установах. Впровадження інформаційних і комунікаційних технологій підвищує ефективність, продуктивність і якість роботи організацій охорони здоров'я, а також надає можливість покращити спілкування між пацієнтами і лікарями. Можливими каналами зв'язку є Інтернет і SMS. Досліджуються можливості використання Інтернет і SMS для спілкування між лікарями і пацієнтами в Республіці Сербія.

Ключові слова: інформаційні і комунікаційні технології; охорона здоров'я; зв'язок; Інтернет- і SMS-послуги.

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СВЯЗЬ ЧЕРЕЗ ИНТЕРНЕТ И SMS В СИСТЕМЕ ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ СЕРБИЯ

В статье определено, что одной из основных проблем здравоохранения и современной медицины в целом является сбор, обработка и использование данных, собираемых ежедневно в виде бумажной документации медицинских учреждений. Внедрение информационных и коммуникационных технологий повышает эффективность, производительность и качество работы организаций здравоохранения, а также дает возможность улучшить общение между пациентами и врачами. Возможными каналами связи являются веб-приложения и SMS. Описано исследование возможностей использования Интернет и SMS для общения между врачами и пациентами в Республике Сербия.

Ключевые слова: информационные и коммуникационные технологии; здравоохранение; связь; Интернет- и SMS-услуги.

1. Introduction. Information and communication technologies (ICT) offer great opportunities and have an overall impact on national economies and global competi-

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tion in the healthcare system. There are many papers that emphasize the importance of ICT through the inclusion of Internet users and IT literacy as indicators of socio-economic development [Jeremic, Markovic, Radojicic (2011); Jeremic, Vukmirovic, Radojicic and Djokovic (2011)]. Information and communication technologies have the potential to be used in order to help citizens and health professionals to develop safer, better, more rational and better integrated healthcare. Information and communication technology is a means to achieve the strategic goals of the healthcare system, i.e. (Jovanovic Milenkovic M., 2011):

- Developing and improving management in all the aspects of the system, by making decisions based on evidence from health professionals, consumers;

- Creating conditions for sustainable financing of healthcare system;

- Measuring critical dimensions of the healthcare system, such as accessibility, parity, quality and efficiency.

10 years of experience in the application of ICT in healthcare in developed countries has shown high economic and medical reasons for investing in this area (Al-Lagilli, Jeremic, Seke, Jeremic, Radojicic, 2011). The relative costs of investing in medical informatics today are very low compared to other costs in healthcare, and the effects of proper use are greater savings through rationalization of costs and the possibility of optimal planning and management in all the aspects of the system. These effects are based on information generated and shared between the segments of the system, which allows making optimal decisions and plans based on quality and updated information about the needs and the state of resources (Hillestad, Richard et al., 2008; Blaya, Fraser, Holt, 2010).

The introduction of an information system increases efficiency, productivity and work quality of a health organization, evaluates work, eliminates duplication of data, provides a more comprehensive use of data. The most important factors that arise by using this solution are [Milenkovic, Jovanovic Milenkovic, Vujin, Aleksic, Radojicic, (in Press)]:

- Improvement of medical services quality, through the possibility of easily and quickly obtaining opinions from other medical experts so that a patient practically receives a service from the virtual doctors council. Thereby, diagnostic and therapeutic quality are on the increase, the work process is automated at the most with errors reduced, early diagnosis and early detection of negative effects of the applied therapy are improved etc.

- Increase of the revenue by increasing the productivity of medical staff (nurses, emergency department, radiology etc.) and by increasing influx of patients.

- Reduction of costs by reducing the amount of supplies and using the same equipment by many experts.

In addition, it should be noted that one of the major problems in healthcare and modern medicine in general is the collection, handling, processing and use of data collected on a daily basis in large quantities and in the form of extensive documentation within medical institutions. Persons during their lives visit various medical facilities that are, by their geographical position, very often distributed. Therefore, sources of medical data generation are also distributed. Data can be generated in field, in temporary clinics, during home visits, all of which introduce an additional factor of physical distribution (Jovanovic Milenkovic, Radojicic, Milenkovic, Vukmirovic, 2009).

Establishment of a healthcare information system and communication between all direct and indirect participants in the execution of business processes provides the availability of a large volume of data and information useful for decision-making and conduction of business processes in general (Jeremic, Seke, Radojicic, Jeremic, Markovic, Slovic, Aleksic, 2011; Chatman, 2010).

2. Communication via the Web and SMS in the healthcare system.

Introduction of information systems in the healthcare results in better communication between doctors and patients. This leads to the emergence of electronic communication which may be based on the use of web services and messaging services. Their application results in [Jovanovic Milenkovic, Milenkovic, Radojicic, Vukmirovic (2010)]:

- better and more direct exchange of knowledge and information between doctors, based on patient's shared electronic files;

- more accessible communication between patients and doctors;

- more extensive and interactive education of the population in disease prevention and patients treatment;

- more rational employment of capacities and increase in utilization of equipment and technical means, through the automated integration of diagnostic and therapeutic information in the patient's electronic record.

Prerequisite for successful communication between doctors and patients is a system of identification. This introduces the identification of target audiences, including:

- a unique identifier of a patient;

- unique identifier of a doctor;

- a unique identifier of a healthcare institution.

Patient's unique identifier associates patient's data, regardless of where they are located, at different locations or on different types of media. Doctor's unique identifier allows unique identification of medical health professionals in the healthcare system and records of their work related to the individual patient and his health problems. Unique identifier for healthcare facilities is used for unambiguous identification of existing public and private health institutions in governing the healthcare system (Frenk, 2010).

Web-service provides access to distributed multimedia data, such as medical information. It leads to easy connectivity with other databases. Web-operating costs are low, taking into account both installation and operating costs.

SMS services enable communication regarding the customer's requirements to receive, periodically or by request, various types of information such as reminders to take therapy, appointments with doctors etc. Two-way communication is also possible so that a user can send parameters that indicate the current status of his condition. Benefits of SMS service are its widespread availability and ease of use. In this way an increase in the value of the sent messages is achieved as they pertain to the exact location, are personalized and timely defined. Of course, SMS service has some negative aspects such as dependency on the load of the GSM network and availability of the signal.

3. Case study. Given that today all the communication in healthcare institutions in the Republic of Serbia is performed in traditional way, by patient's physical visit to a doctor, it points out too many flaws. Basic characteristics of such communication

are that all data are on paper and doctors use a lot of time on searching and sort patient's data in order to obtain a total picture of patient's treatment and care. On the other hand, a patient spends time waiting for doctor's reception, which results in poor continuity and non-systematic approach to monitoring patients' health.

The case study described in this paper aims to examine ways to improve communication between doctors and patients, by using web and SMS services.

For the purposes of this research a software solution was implemented, based on application of two-way communication between doctors and patients enabling continuous monitoring of critical parameters of chronic patients that reflect the degree of patients vulnerability. Software solution was implemented on a concrete example of monitoring patients taking anticoagulant therapy. Anticoagulant therapy is a medication treatment that prevents forming and/or activity of thrombin and thereby blocks the coagulation cascade. It is used on the patients with risk of thromboembolic complications. Application of anticoagulant therapy reduces the possibility of unwanted intravascular coagulation. To avoid these side effects, it is necessary to monitor regularly the activity of anticoagulant therapy, which can be seen by measuring the INR (international normalised ratio). INR is the ratio of the patient's prothrombin time and prothrombin control time (Jiehui, Zhuangzhi., Jun, Prabhu, Freudenthal, 2010; Francetic, Bakran, Huic, Marcelo, Makar-Ausperger, Erdejic, 2007; Fayn, Rubel, 2010).

Communication in the application solution is started by the patient. At the beginning the patient has to log on to the system, followed by entering the data into the application. Data entry is possible via sending SMS or via web. The system receives the data and access records corresponding to the patient identified. The data are stored in electronic medical records and the patient's database. The doctor also uses the application. He checks the data entered and controls whether the dose patient is taking is adequate. In case of emergency, he must contact the patient by a phone call.

4. Results and research analysis. The study was conducted in accordance with the Helsinki Declaration of 1975, revised in 1983, with the approval of the Ethics Committee of the Institute for Blood Transfusion of Serbia and the written consent of all the patients who have been involved in the research. The target group consisted of 200 patients who were taking oral anticoagulant therapy and were regularly monitored at the Centre for study the hemostasis disorders at the Blood Transfusion Institute of Serbia, in Belgrade.

The group of subjects included 116 men and 84 women aged 20 to 82 (median 61 years). The criterion for inclusion into the study was that patients were on stable anticoagulant therapy, or in therapeutic INR range for the last 3 months. The study lasted for one year, during which the patients entered the value of INR every 2 weeks. The study analysis was discussed in several time points — after a month, 4 months, 6 months, 10 months and 12 months.

After a year of research, the following conclusions have been made. At baseline, included patients accepted the new way of controlling their health. Over time, a number of patients stopped using electronic communication and entering INR values of blood into the application. In these cases, the process of treatment and aftercare continued in the traditional way, and the patients went to the health institution to see their doctors.

Table 1 shows the percentage of patients who were entering INR values in relation to 5 time points.

Table 1. **Percentage of patients entering INR values**

Timeline	%
After a month	100%
After 4 months	85%
After 6 months	70,3%
After 10 months	59,26%
After a year	59,26%

After research completion, it has been concluded that 118 patients checked their INR values and entered them into the application all the time, which makes 59.26% of the patients included. It is believed that this ratio is high, in terms of patients age, because the median age was 61.

Given that the application access was possible from computer or a mobile phone, the survey showed that most of the INR value inputs in the application were via SMS. It comes from the fact that using mobile phones to access the application is easier for several reasons:

- it is possible to access the application at the exact time;

- it is possible to access the application regardless the current location of the patient;

- 82.7% of Serbian population uses mobile phones (Vukmirovic, Pavlovic, Sutic, 2011).

Percentage of computers and mobile phones usage for entering INR values during the year is shown in Graph 1.
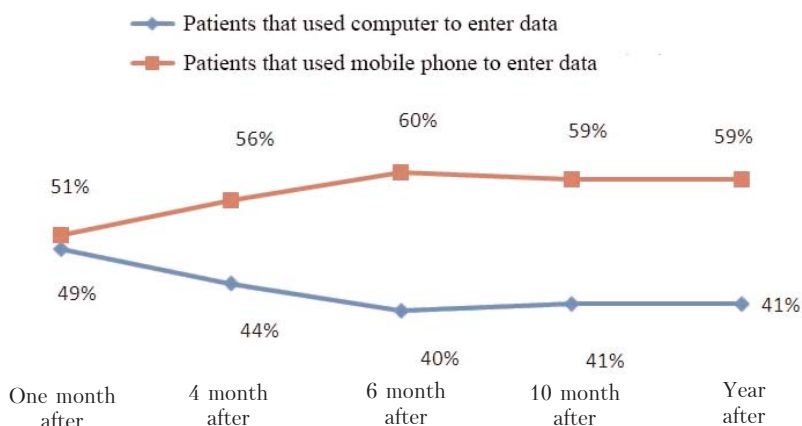

Figure 1. **Graphical presentation of using computers and mobile phones to enter INR values**

5. Conclusion. The role of ICT in healthcare reform is growing in parallel with the increasing influence of markets on the survival and development of health facilities and the results of people who make it. Establishment of a healthcare information system and communication between all direct and indirect participants in business processes provide the availability of a large volume of data and

information useful for decision-making and conduction of business processes in general.

The paper describes the research concerning the willingness of population to communicate with doctors via web and SMS. The result indicates that there is an interest and positive attitude towards the introduction of such a form of communication in the healthcare system. Guided by this result, it is necessary, at the state level, to acquaint the population with possibility to use ICT in the healthcare system. This would affect the increase of awareness about the improved process of the healthcare system and introduce new ways of communicating with doctors. This indicates that the treatment process remains the same, but the manner of its execution becomes easier and much more efficient.

Speed of development and deployment of new technologies in the healthcare system suggests that the implementation of such systems in the Republic of Serbia is not a question of necessity nor feasibility, only a matter of time.

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