

# Information Technologies Supported by Innovation In the field of Health

Dragan D. Obradovic <sup>1\*</sup>, Nebojsa Denić <sup>2</sup>, Dragisa V. Obradovic <sup>3</sup>

<sup>1</sup> Department of Mathematics and Informatics, School "Agricultural High School" Pozarevac – Serbia.

<sup>2</sup> Faculty of Natural Sciences and Mathematics, Kosovska Mitrovica – Serbia.

<sup>3</sup> Association of Engineers and Technicians - HTM Pozarevac – Serbia.

\***Corresponding Author:** Dragan D. Obradovic, Department of Mathematics and Informatics, School "Agricultural High School" Pozarevac – Serbia

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## Abstract

Digitization of the health system requires much more than replacing "classic" technologies with digital ones. Changes are necessary in many business processes in which the active role of health professions and their cooperation with other professions participating in the digitization process is expected. Today, medical informatics is accepted as a basic medical science. An analogy with other basic sciences is recognized in the use of previous experiences and results, with the aim of structuring and coding objective and subjective medical findings, which makes it suitable for analysis, integration and further use. Decision-making in medicine, especially in clinical practice, most often represents the application of decision analysis in clinical conditions, with the aim of using medical and other data to assess the probability of different outcomes, in cases where alternative decisions in diagnosis or therapy are possible. Evidence-based medicine is a global movement across all health science disciplines. Information storage, retrieval, and communication are key features of both medical practice and health care administration.

**Keywords :** medical informatics; information technologies; information systems; healthcare; business process improvement

## 1. Introduction

Medical informatics or health informatics is a science that studies the laws of creation, transfer, processing and use of information, data and knowledge in order to solve medical problems. Medical informatics, as we know it today, emerged when computer technology became sophisticated enough to manage large amounts of data. Although there were earlier experiments in the field of dentistry, it was only in the 1960s that medical informatics was standardized and accepted as a basic medical science, which, by analogy with other basic sciences, is recognized by the use of previous experiences and results in order to structure and code objective and subjective medical findings, thus making them suitable for analysis, integration and further use. Medical informatics, for its part, participates in solving the problems of data processing and information production and transmission of that information, thus contributing to avoiding or at least mitigating the information crisis. Medical informatics deals with the

systematized processing of data, information and knowledge in medicine and healthcare. Medical informatics is a combination of the fields of information technology and medicine with the aim of developing systems necessary for the administrative dissemination of information, improvement of clinical work flow and improvement of health system security. This includes the integration of information science, computer technology and medicine in order to collect, organize and secure information systems and health data. The great expansion of medical knowledge, the development of technologies and new drugs can significantly improve the quality of healthcare services for patients, and knowledge of these areas and monitoring their development are the keys to success.

These systems should also enable integration of clinical guidelines and directives, understanding and acceptance of formal medical jargon, data storage and linkage, transfer and clear communication.

Medical informatics can be applied in all areas of health care: in the field of primary health care, general practice, hospital treatment, rehabilitation, including various specialist areas of health care. Information systems can be used to create greater operational efficiency in the three basic functions of health care: clinical, administrative, and financial. Students are able to identify and formulate problems and face challenges in the field of medicine and health care by applying information technologies, apply technologies and telecommunications software engineering in health care through problem solving by applying and developing solutions from the field of e-medicine in accordance with international regulations and standards, designs and applies basic methods for the processing and analysis of physiological signals and for the analysis of medical images.

The application of information systems (IS) has spread to almost all areas of human activity and enabled more efficient work. One of the most important areas of application of information systems is medicine, i.e. health care. The result of this application is a large number of information systems that differ in the field of application and scope. Thus, a large number of categories of information systems in the field of healthcare emerged: medical information systems (MIS), hospital information systems (BIS), radiological information systems (RIS), laboratory information systems (LIS), etc. In most cases, existing ISs cover one domain and have very few interactions with other ISs in healthcare and almost none with other ISs that cover other segments of a society, which significantly affects their practical usability. However, as the application of IS in various fields develops, situations are increasingly identified when the current state is characterized as unsatisfactory and when it is necessary to change the existing medical information systems and above all their concepts and settings and enable their interaction and collaboration not only at the level health institutions, that is, the health care system, but also more widely with other systems.

### **Contribution to the Improvement of Health Services**

Today, it is difficult to imagine healthcare without information and communication technologies (ICT). Information technology in healthcare has been around for about three decades and has gained widespread use. Electronic patient records offer healthcare professionals access to a vast amount of patient-related information; decision support systems support clinical actions; and knowledge servers provide direct access to cutting-edge clinical knowledge to support evidence-based medical practice. Communication technology has provided standardized communication protocols related to health care, which enable the exchange of all kinds of information between parties in health care. Networked health environments are developing in which regional health information systems support seamless care, thereby enabling delivery and access to health services and health-related information across organizational, regional, and national boundaries. Health care is truly entering the information society. 2

Health care spending accounts for a significant and growing portion of gross domestic product (GDP) in many countries. Policymakers and health leaders are faced with the twin challenges of increasing access to quality health services and managing the rate of growth in health care spending. They are increasingly looking to information technology (IT) to play an important role in improving quality and access and cost management. However, the effective development,

implementation and use of health care IT represent enormous challenges. Medical informatics (MI) has developed as a research field aimed at realizing the potential for the use of computer and information technologies in health care, which has produced valuable knowledge about health care IT. As healthcare organizations increasingly adopt IT across a wide range of functions and processes, the challenges of developing, implementing and using healthcare IT will continue to grow.

Information technology (IT) is emerging in healthcare. For example, decision support systems are being introduced, knowledge servers provide direct access to the most up-to-date clinical knowledge, and healthcare worker workstations offer a vast amount of functionality (such as order entry, workflow management, report writing) to support inpatient and outpatient healthcare professionals. units.

It is obvious that the use of modern information technology offers enormous opportunities to reduce clinical errors (eg medication errors, diagnostic errors), to support healthcare professionals (eg availability of timely, up-to-date information about patients), to increase efficiency of care (eg less waiting time for patients), or even to improve the quality of patient care.

Medical informatics represents an area in which a key contribution can be made to the improvement of health services while reducing costs. It develops methods by which medical data, information and knowledge can be handled more efficiently, reliably and economically, and made available to a wide range of users and providers of medical services through computer networks. That is why information technologies, which include computer and telecommunication technology, are an important tool of medical informatics.

### **3. Standards in Medical Informatics**

Increasing data flow and the desire to manage costs as best as possible are two characteristics of modern informatics, healthcare organizations must also face the variability of funding, the rapid development of the profession and the high expectations of patients. Until recently, most information was exchanged by organizations through letters and mail, then via telex and telefax, and probably most information today travels by e-mail and other electronic means. However, only a few information systems allow the exchange of data (e.g. on patient examinations or orders to suppliers) without manual intervention. There are mainly reasons for this in data incompatibility, mistrust between organizations and deficiencies in data quality assurance. In recent times, the realization has matured that the above-mentioned problems can be solved much more easily by considering generally valid standards - especially standards for data exchange (eg for electronic medical records), for information security management and to ensure the quality of services. In recent years and decades, a lot of effort has already been invested in the development and 3 implementation of standards, but it seems that expectations have exceeded the results. In the coming years, the standards will enable faster access to general information with requirements such as non-duplication of data, real-time updating, fast transfer and secure exchange. Therefore, the standard in the field of data security management (ISO 17799) enabled trust between

organizations, which is the first condition for direct data exchange. Global or local data standards and quality of service standards will play a similar role.

The introduction of standards will accelerate or even condition development in many areas, among them: direct connection of information systems of different organizations in healthcare and beyond, creation of an electronic record about the patient (data will be physically located on different media and locations), the possibility for the patient to efficiently examine own data that has been collected for years, ensuring control, confidentiality and detection of possible abuses in the use of personal data.

The main obstacles in the adoption and implementation of standards in the organization are difficulties in unifying opinions and interests, lack of management support, resistance to organizational changes, lack of adequate documentation and lack of resources and adequate personnel. It seems that these will be essential problems in the further development of informatics in healthcare. If we manage to solve them satisfactorily, we can expect rapid development, which will be especially influenced by approaches that are already used today with less extensive data and in related fields. Those who are not ready for this development in time will find it difficult to join it later, since it is known that the introduction of standards is a long-term process. Therefore, today almost no one doubts the correctness of the introduction of standards, only opinions are divided on how to deal with it as efficiently as possible. Adequate personnel is very important - because it is about projects that include many areas of activity of each organization, experienced experts will play a key role in cooperation with external colleagues. Adequate staffing support for the future must also be provided, as it is known that processes such as safety management and quality assurance are never really completed. Therefore, it is expected that there will be more care for own personnel and additional demand for successful personnel from outside the organization.

In recent years, many large projects have started in medicine, which at least partly include standards and informatics, among which is the project for the development of health system management, which tries to introduce standards into many segments of health care. All these projects are just beginning, but due to their scale, results can only be expected in a few years. The participation of health organizations in these projects will be one of their most important tasks in the coming years, because it is expected that only through these projects they will gain the basis for using new access technologies and the basis for effective cost management and easier integration with Europe.

#### **4. Improvement of Business Processes in Healthcare**

The introduction of new IT solutions requires that informatics knows the complete workflows and data in a healthcare institution. The IT job is not only a technological challenge, there is also the underlying business system and the medical profession, which are both complex and sensitive. Application-driven changes come in the form of electronic health records, multimedia storage systems, transparent and digitized ordering systems, digital document management,

mobility and monitoring of patients and equipment through wireless technology, telemedicine. The desired results are better system security, efficiency, patient at the center of events, timeliness and impartiality of the system. Optimal manageability of the health care system based on timely, accurate, complete and simple business information is key. A well-integrated information system creates the conditions for managing a business system based on business intelligence. Changing the way healthcare is delivered using IT is undergoing major changes. Health care is provided with new conditions, in a new way, with new service providers, including interactions with patients. Regulatory compliance, satisfied staff, constant struggle with health care costs, patient satisfaction, quality of care and patient safety make up the architecture of jobs and solutions in healthcare. It's all based on information technology and the people who manage that technology.

Improvement of the business process represents: introduction of new production lines, use of new technical solutions, use of by-products, use of robotics, automation improvement, design and use of the information technology sector. Improvement of the business process through implementation improves business in the national framework, but also multiplies the improved business in the international framework, achieving projections of success and efficiency. By analyzing the effects of improving business processes, we obtain basic data on the multiplication of success on wider concentric business circles.

By gradually connecting an increasing number of computerized health institutions with centers of electronic health records, the importance, quality, and use value of the information contained in the database of the electronic health records system will increase and thereby confirm the effectiveness of evidence-based medicine. Also, the system of electronic health documentation lays the foundation for a new approach to organizing and performing business processes in the health system supported by information and communication technologies. This new approach is characterized by patient-centeredness, evidence-based medicine, sharing information about the patient's health in order to improve health services and reduce costs.

#### **5. Advantages of the Introduction of E-Cartons**

Computerization and the introduction of information systems in healthcare facilities opened the way for the creation of the concept of a computerized medical record, which enabled all data about and for the patient to be in electronic form. This way of storing medical information creates the potential for significantly improving the quality of medical services and increasing the effectiveness of medical practice. Healthcare institutions that have introduced e-carton have shortened the administrative path to the lowest possible level, with a completely accurate insight from the services provided to the data entered in the prescription. E-carton has a systematic internal model of all the information it possesses and supports the efficient collection of information in accordance with the internal model. By increasing the efficiency of health care and safety through the widespread use of electronic records, huge financial savings are achieved.

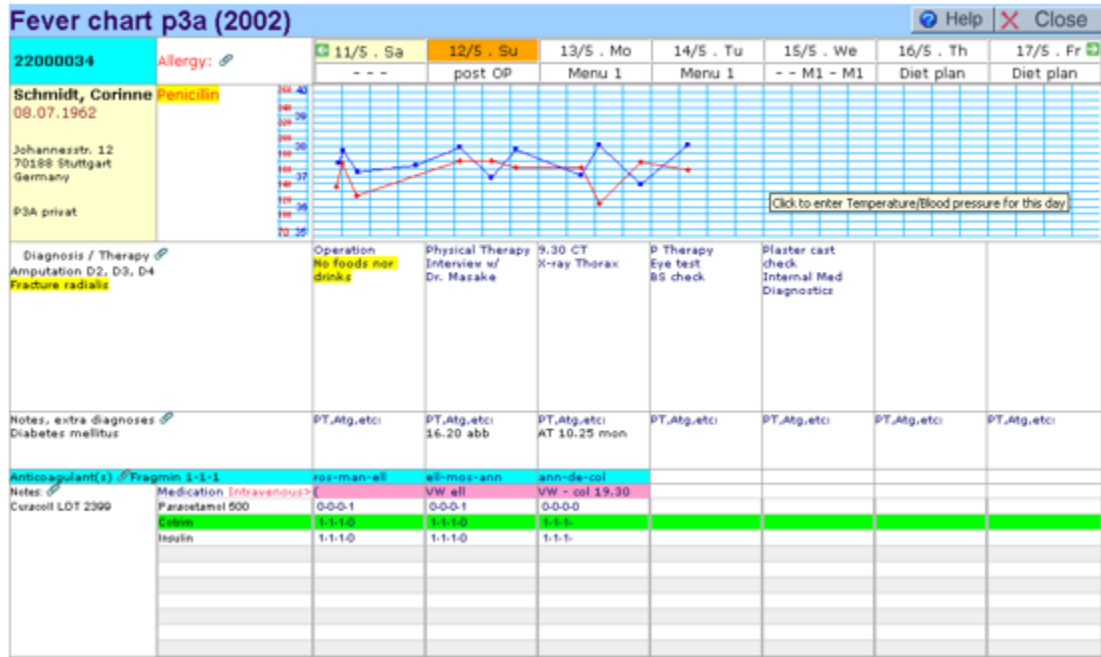


Figure 1: Electronic patient record, without which medical informatics is unthinkable

Numerous studies have shown improved access to patient information and documents after the establishment of e-cards in terms of increased availability, especially specialist consultation. The existence of some limitations was observed, since not all the expected information can always be found in the e-Carton, especially those related to the period before the introduction of the e-Carton, which can create uncertainty or an obstacle in reliable decision-making in complex clinical conditions. The quality and accuracy of data improved after the implementation of e-Carton, and an improvement in the quality of medical documentation in the format and content of records was observed. Medical documentation was significantly more reliable and better aligned with professional and clinical guidelines. After the establishment of e-Carton, changes were observed in the sense of increasing income based on the valorization of new IT services in the form of health e-consultations, which became stimulated and formally defined.

## 6. scientific Contribution by Introducing Information Technologies in Healthcare

Information that is generated and transmitted within health information systems has specific purposes. In the function of maintaining health and medical documentation - when it comes to this topic, it should be said that the number of data collected in healthcare institutions is very large. The provision of medical services is an extremely specific and complex job, the main characteristic of which is the number and variety of data and information. Modern health care processes are built on the fact that information must be accessible at the time and place where it is needed. Requests made in this way can only be answered by using a computer. In medical diagnostics - computers are used in the processing and analysis of biophysical signals, then in the processing and analysis of medical images according to the procedures of computed tomography - CT, then images obtained with MR. The achieved results, in addition to the indisputable benefit, opened up many questions and dilemmas and led to new ideas for further work and research that can go in several directions. They can range from the creation of new software modules of the medical information system for internal use in the health center, through integration with existing and new medical and non-medical state information systems and services,

through the implementation of developed deep learning models in a real system and the development of new deep learning models to the physical implementation of the proposed personalized machine for dispensing medicines to patients and all this in order to provide an efficient response of the medical information system in the event of an epidemic or pandemic of an infectious disease.

Further development can go in the direction of realizing both horizontal and vertical integration and collaboration of health information systems at all levels of patient health care. Emphasis can be placed on the implementation of integration and creation of a large smart and efficient health information system. In fact, it can also be reflected in the integration of a smart patient healthcare information system into the concept of a smart city.

## 7. Conclusion

Modern health management and modern medical technologies are highly correlated. This means that health managers and experienced medical personnel who are entrusted with organizational and administrative functions can and must be a team, with the common goal of developing health institutions and health services. The functioning of health institutions has its limits and limitations in the way and scope of financing the entire needs of a modern and efficient health care system.

Medical informatics is an emerging discipline characterized by rapid development and exciting new initiatives that promise to have a significant impact on medical practice. Dramatic technological changes, such as those occurring today, always go hand in hand with profound social and cultural changes. Tension and strife arise when proper attention is not paid to them. It is well documented that technological development often outstrips its productive use in the community of practitioners. The improved functionality and efficiency provided by new machines must be balanced with concerns for usability, learnability and adaptability to the needs of the environment. With constant change being one of the few certainties, the challenge is to adapt to the ever-shifting balance between recognizing and promoting these technological changes and understanding the social consequences. Stable paradigms for clinical computing are somewhat elusive for now. As long as there is complementarity between the social and



cognitive on the one hand and the technological on the other, a satisfactory balance can be more easily achieved.

It is of great importance to work on the recognition, recognition and promotion of health management as a profession. By focusing attention on building professional capacities, strengthening managerial skills and abilities, as well as using positive examples and experiences of the so-called best practices, especially from developed countries, the entire health system gets the opportunity to modernize and improve.

## References

1. Deželić Gj. (1987). Health informatics. Faculty of Medicine, University of Zagreb, Zagreb
2. Dotlić R, Maksimović R, Dragičević T, Gajić M. (1995), Medical informatics education at the Faculty of Medicine in Belgrade. *Srp Arch Celok Lek* 123 Suppl 2: 1-4.
3. Marinković J, Babić D, Maksimović R, Stanisavljević D. (1995); Elements of computer support in scientific research in the field of medicine. *Srp Arch Celok Lek* 123 Suppl 2: 14-17
4. Pavić, Ž. (2007). Healthcare and healthcare system. Belgrade: Serbian Medical Association. WHO, S. z. (1977). WHO Resolution on the Global Strategy "Health for All by 2000". WHO.
5. Benson T. (1992). Medical Informatics. Longman Health Services Management, UK
6. Blois M. Information and Medicine: The Nature of Medical Descriptions. University of California Press, Berkeley and Los Angeles 1984.
7. Dačić M. Biomedical scientific informatics. Scientific book, Belgrade 1991.
8. Seelos HJ. (1988), Indivisibility and Variety of Medical Informatics. *Meth Inform Med* 27 (4): 191-193.
9. Simić S, Marinković J, Stanojević S, Radovanović M, Anđelski H, Atanasković Z, Grujović G, Pavlović Ž, Đukić Lj, Obradović M. (1995), Analysis of the state of information technology in healthcare institutions of Serbia. *Srp Arch Celok Lek* 123 Suppl 2: 5-8.
10. Avdić A., Janković D. (2018) The importance of e-Health in the concept of smart cities, 17th International Symposium INFOTEH-JAHORINA, 2018, 383-387.
11. Avdić Dž., Avdić A., MEDIS questionnaire - application of mobile computing in medicine, Society for Information Systems and Computer Networks YUINFO, 2016, 321-324.
12. Milenkovic A. M., Rajkovic P., Stankovic T., Jankovic D. S. (2011), Application of Medical Information System MEDIS.NET in Professional Learning, 19th Telecommunications Forum (TELFOR) Proceedings of Papers, 1474-1477.
13. Garla V., Re L., Dorey-Stein Z., Kidwai F., Scotch M., Womack J., Brandt C. The Yale cTAKES extensions for document classification: architecture and application; *Journal of the American Medical Informatics Association*, 2011, 18(5), 614-620.
14. Soysal R., Wang J., Jiang M., Wu Y., Pakhomov S., Liu H., Xu H. (2017), CLAMP - a toolkit for efficiently building customized clinical natural language processing pipelines, *Journal of the American Medical Informatics Association* , 25(3), 331-336.
15. MacLean D. L., Jeffrey H. (2013), Identifying medical terms in patient-authored text: a crowdsourcing-based approach, *Journal of the American Medical Informatics Association*, 20(6), 1120-1127.
16. Lai H., Topaz M., Goss R., Zhou L. (2015) Automated misspelling detection and correction in clinical free-text records, *Journal of biomedical informatics*, 55, 188-195.
17. Topol E. *Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care*. New York: Basic Books; in 2013
18. Larkin M. Dr. Eric Topol: (2017) Digital healthcare will put the patient in charge. 2014 October (cited Dec). Available from: <https://www.elsevier.com/connect/Dr-Eric-Topol-Digital-healthcare-will-put-the-patient-in-charge>
19. Jung AK. (2013) Book Review: *Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care*. *Healthc Inform Res. Sep; 19(3): 229–231*.
20. Galewitz P. Medical practices increasingly allow online appointments. *U S A Today*. January 3, 2011.
21. Blumenthal D, Tavenner M. (2010) The “meaningful use” regulation for electronic health records. *N Engl J Med.*;363(6):501–504.
22. Bates DW, Teich JM, Lee J, (1999); et al. The impact of computerized physician order entry on medication error prevention. *J Am Med Inform Assoc.* 6(4):313–321.
23. Walker J, Pan E, Johnston D, et al. (2005); The value of health care information exchange and interoperability. *Health Aff (Millwood)*. Suppl: W5-10-W15-18.
24. Chaudhry B, Wang J, Wu S, (2006); et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med.* 144(10):742–752.
25. Goldzweig CL, Towfigh A, Maglione M, Shekelle PG. (2009); Costs and benefits of health information technology: new trends from the literature. *Health Aff (Millwood)*. 28(2):w282–w293.
26. Dexter PR, Perkins S, Overhage JM, (2001) et al. A computerized reminder system to increase the use of preventive care for hospitalized patients. *N Engl J Med.*;345(13):965–970.
27. Willson D, Ashton C, Wingate N, et al. Computerized support of pressure ulcer prevention and treatment protocols. *Proc Annu Symp Comput Appl Med Care.* 1995:646–650.
28. McDonald CJ, Hui SL, Smith DM, et al. Reminders to physicians from an introspective computer medical record. A two-year randomized trial. *Ann Intern Med.* 1984;100(1):130–138.

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