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INITIAL IMPLEMENTATION AND FUTURE DEVELOPMENT OF INTEGRATED HOSPITAL INFORMATION SYSTEM IN CANTONAL HOSPITAL ZENICA

Dr.Sc. Senad Balić
University of Zenica, Faculty of Mechanical Engineering
Fakultetska 1, 72000 Zenica
Bosnia and Herzegovina

Jedin Čaušević
Cantonal Hospital Zenica
Crkvice 67, 72000 Zenica
Bosnia and Herzegovina

M.Sc. Nedžad Šaranović
BH Telecom
Masarykova 46, 72000 Zenica
Bosnia and Herzegovina

ABSTRACT
Introduction of computer information system is the key to increasing the level of efficiency and effectiveness in health organisations business.
This paper presents the results in areas of implementing health care information systems in Cantonal Hospital Zenica(CHZ), strategy of further informatisation, introducing new ICT technologies in the same hospital and integration of health care information systems with the goal of achieving business excellence and creating the base for integration with centralized health information system, as well as achieving compliance with current European Union standards regarding this hospital.
Keywords: integrated hospital information system, Cantonal Hospital Zenica

1. INTRODUCTION

Health organisations and hospitals in Bosnia and Herzegovina are trying to introduce information technologies in their business and through this improve patient care on one side and hospital business efficiency on the other side. It is evident that health care system in Bosnia and Herzegovina does not have the necessary resources for a large scale informatisation and information technologies introduction, but also is missing concrete directions and methodologies for implementation of these technologies in hospitals and health care system as a whole.
Only integrated and well developed information system will help in achieving the necessary goals. And those goals in modern ecenomy, even for hospitals, are to achieve business excelence and at the same time keep the same level or even improve the patient care and patient relationship.
This paper presents current state of information systems in Cantonal Hospital Zenica(CHZ) and gives the general directions and proposals for future development having in mind the goals of achieving business excellence, increasing the quality of medical service and increasing the hospital staff efficiency and satisfaction. On the other hand this future development will enable CHZ to actively participate and integrate with future health information system on the level of Bosnia and Herzegovina enabling the e-health through this integration.

2. PREREQUISITES AND MAIN GOALS

The implementation of strategy of integrated hospital information system(HIS) development in CHZ started in first quarter of 2007. Development of CHZ hospital information system is in direct link with

other parallel projects which include: building and furnishing of Radiology department building which houses state of the art Magnetic Resonance Imaging(MRI) and Computer Tomography(CT) devices, oncology department expanding, introduciton of standardized processes (AKAZ – Agency for medical care quality and standards in Federation of Bosnia and Herzegovina), adaptation of departments for pediatrics, neurosurgery, plastic surgery, human reproduction, orthopedy, thraumatology, urology, transfusiology, as well as building of new energy block in CHZ.
In its final state, integrated hospital information system in CHZ should enable reliable, fast and efficient manipulation and storage of patient, hospital human resources, material management and medical devices data, enable financial flows and expenditures monitoring, as well as business planning and decission making support. The same system should provide preconditions for data and knowledge exchange, cheap communication, distance diagnoses and treatment, video communication and communication with other health care institutions like public health care institutions thus providing the means for e-health system. On the other hand the system should be open for new groupers and DRG financial methods introduction.

3. CURRENT LEVEL OF DEVELOPMENT OF HIS IN CHZ

Current level of development of hospital information system in CHZ was reached through two development phases as follows:

Phase I (2007-2010):

- Implementation of LAN in CHZ, server concentrators and optical links (2007),
- LAN connection to internet, WEB hosting, mail service, staff computer education (2007),
- Informatisation of financial sector (financies, accounting, material management, central pharmacy, public supplies, e-banking) (2008/2009),
- LIS – Laboratory Information System:
  - Biochemistry – central laboratory processes informatisation (2008),
  - Microbiology – Microbiology diagnoses informatisation (2009),
  - Pathology – Patology department informatisation (2009),
  - Transfuziology (2009);
- IP Telephony (2009),
- TanderBerg Videoconferencing system (2009),
- IBM BLADE Server (Windows 2008, SQL Server 2008), Virtualisation (2010),
- PACS/RIS - Picture Archiving and Communication Systems / Radiology Information System, RTG – picture diagnostics (2010),
- Informatisation of specialized medical clinics (2010);

Phase II (end of 2010):

- HIS – Hospital information system – medical diagnostics (electronic medical record) – expanding to 120 concurent licencies and integration of LIS and PACS/RIS systems
- dialysis – Informatisation of dialisys separtment (VPN connection with distant dialisys centers in Visoko and Žepče),
- integration of ultrasonography and GAMA camera in PACS,
- Exchange Server, ISA Server, uthorisation and authentication using electronic chip cards

All applications used in hospital information system in CHZ are web based and this is main approach for applications in this hospital.

4. CHZ COMMUNICATION INFRASTRUCTURE

Basic CHZ communication infrastructure consists of a local Ethernet network which covers the entire campus area of the mentioned hospital, which ensures infrastructure for computer communication, servers, and diagnostic equipment in the hospital.
Hardware basis of the CHZ network consist of active components of a computer system, optical-software managed switches and server platform based on a pair of IBM BLADE processing units with 8 physical processors, 32GB RAM and 6TB of disk storage space. The CHZ local network includes 200 client-computers, 8 optical switches, 4 routers, 100 IP phones, 15 biological and chemical analyzers, 2 CTA, MRI device, 10 ultrasound machines, 2 microscopes, gamma camera, 20 network printers, 2 Video Phones and 2 high resolution HD camera supported by videoconference system

devices. All devices are connected to each other by optic links and copper UTP connections category 5e and 6e. This hardware communication platform is defined by a single logical domain "KBZenica" that is controlled by the two DNS servers that are automatically replicated and thus ensure safe operation, reliable data backup and a high degree of availability of the system.
Communication with systems outside the local network takes place via a DSL connection and a separate optical link for video communications used for the needs of the local videoconferencing.
The above communication infrastructure provides a basis for building an integrated information system that will enable the achievement of defined goals and achieving business excellence. It can be concluded that the CHZ communication infrastructure is well developed and that in its current capacity allows the further computerization of all parts of the hospital system and the smooth promotion of the existing hospital information systems.

5. DIRECTIONS FOR FURTHER DEVELOPMENT OF CHZ HIS

Further development of HIS in the CHZ is planned through the implementation of Phase III (2011 -), which will include:

- human resources management, management of warehouse and technical resources, spare parts and food - modules of Enterprise Resource Planning (ERP) systems;
- Document Management System (DMS, centralized and automated flow of documents and archives);
- digitalization of conventional radiology and its integration with the PACS (RTG without classic film);
- integration of the general financial software in the HIS (financial indicators per patient) - preparation for the implementation of the DRG method - Gruppers and connection with Institute of the Public Health;
- INFO centralized service desk - Automation receipt and distribution of patients at 3 info desks;
- the introduction of elements of telemedicine;
- centralized management of energy resources;
- centralized management and security alarm systems and video surveillance;

Based on the facts about the state of the application of information technology in CHZ, it can be concluded that further development of information system in this institution, and the development of computerization of the institutions of this type generally can move in several directions. These directions depend on the objectives to be achieved and include further development towards the treatment of patients and medical diagnostics, and further development in terms of achieving business excellence. Given that the ultimate goal is to achieve business excellence, in this hospital information system two essential components can be implemented and integrated: Document Management System (DMS) and Enterprise Resource Planning (ERP) system for monitoring the operations and human reources in the hospital.
It is evident that monitoring the flow of documents in the CHZ is not supported by any component of information system, except in a limited extent by the laboratory and radiology information system, which partly follow the records of patients. Besides the problem of monitoring documents and supervision over the use and modification of documents, there is the issue of filing the new and correct archiving of old documents, already archived in paper form. These problems would be solved in a unique way by DMS, which would define the flow of documents, and access rights over any of the documents in the system. At the same time electronic archive would be created, thus finally resolving the question of archiving data in a safe environment.
By implementing of ERP system modules for business monitoring the problems of human resources management in CHZ, as well as issues related to financial operations of the hospital would be solwed. This would allow management of CHZ to access more usefull data, which would ultimately facilitate decision making in the management of the institution.
The maximum utilization of these two systems (DMS and ERP) could be achieved only by integration with the mentioned HIS, in which individual health information systems are integrated. Such integration would connect the financial data about CHZ with the data from individual medical departments in the CHZ and the DMS to follow the movement of documents and their use in different departments, regardless of where the document was created. DMS would also be responsible for

control over access to sensitive data such as results of diagnostic examinations, but also for the correct tracking of documents such as electronic medical records throughout the hospital system.

6. ELECTRONIC MEDICAL RECORDS AND HEALTH PORTAL

Patient electronic medical records can be seen on two levels. These levels are represented through hospitals and centralized system of health care. Taking into account this fact, and the current state of development of information systems in CHZ, which represents a reference hospital, we can say that for the introduction of electronic medical records in this institution initial preconditions were made in terms of building communications infrastructure and implementation of laboratory and radiology information system which made the first steps toward creating a unique patient records.

Electronic patient record created like this is a good basis for achieving better results in terms of providing services for patient, but also in terms of business planning, further analysis of group data, and ultimately achieve business excellence of CHZ. However, this electronic card is applicable only in the mentioned hospital facility, given that at present there is no centralized integrated health information system which would include all electronic records of patients, irrespective of which medical facility they are treated in. However, looking only at CHZ, it can be concluded that the basic version of the electronic patient records already exist and that the data manipulation and storage of these confidential information could be further improved by introducing the information system for management of documents (DMS) which would be integrated into the CHZ HIS.

Health portal, on the other hand, is focused mainly on the public health system, because individual health care institutions like hospitals generally have neither the human nor financial resources for projects of this type. However, the information offered through health portals in the health systems of developed countries, such as a online medical advice, issuing new prescriptions, or monitoring of patients and online diagnosis of disease, are of immeasurable value primarily for patients but also for healthcare workers who in this way can help in cases where usually they cannot. For implementation of the project of functional health portal a few prerequisites should be fulfilled, of which in Bosnia and Herzegovina most important are the existence of a unique health information system, the existence of a unified electronic medical records of patients, the introduction of electronic drug prescriptions, as well as connecting of all healthcare institutions into a single computer network.

7. CONCLUSIONS

The strategy of development of an integrated information system of the Cantonal Hospital Zenica brought this system into a form and at a level which represents the typical form of health information system for healthcare institutions of the size and type CHZ is, in Bosnia and Herzegovina. At the same time, this system represents the basis for further computerization, introduction of new ICT technologies and the integration of health facilities at lower levels of health care in the Zenica-Doboj Canton and beyond.

To achieve the objectives in terms of achieving business excellence in CHZ, the strategy of further development of CHZ HIS should include activities that support implementation and integration of the required modules of ERP and DMS systems.

The establishment and further development of HIS in the CHZ represents a way for establishing of conditions for inclusion in the centralized integrated health information system at the federal and country levels.

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