

# THE ROLE OF HOSPITAL INFORMATION SYSTEMS IN SUCCESSFUL HEALTH AND EHEALTH SERVICES IN HUNGARY AND IN INTERNATIONAL DIMENSION

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## Abstract

*The study presents the importance of health sector and the usage of information and communication technologies (ICT) in support of health and health-related fields. ICT has an increasingly essential role in the healthcare system. Although most hospitals in Europe have some kind of an information system in place, only a few of them have “fully” integrated and functional hospital information systems<sup>1</sup> solutions installed<sup>2</sup>. The study aims to show the overall health and eHealth situation in Europe and the different health information systems, which are indispensable to deliver health care. The main development ways of the medical informatics will give a picture about the Hungarian health information systems through hungarian case study based on a survey. The role of HIS is crucial in the development of health and eHealth services. The study also shows some indicators which can measure and compare the eHealth levels in Europe.*

**Keywords:** *Health, eHealth, eServices, Hospital Information System, European Union*

## Introduction

The main aim of this paper is to describe the importance of the healthcare sector and the role of ICT in support of health and health-related fields. The increasingly essential role of ICT in the health sector, assume the operation of the hospital information systems, which are necessary to deliver health care. The paper describes the Hungarian hospital informatics, mainly the complex health information systems, mobile informatics tools, solutions and the barriers to its further development. Furthermore the study presents the wide range of the existing health information systems in Europe to give an international dimension to the topic. The study shows how important are these systems in supporting the health and eHealth services.

The hospital information systems (HIS) are able to transmit, gather, and evaluate medical information. The effectiveness of these systems can be observed in different fields in the hospitals. The challenges of the health system acquire the use of state of the art HIS solutions. The role of these systems is also important to improve the quality of care to patients.

The study contains a Hungarian case study based on a survey, presenting the Hungarian situation. An international comparison will be also shown inside Europe regarding the health sector and the usage of different type of HIS. The paper explores the present state of the health sector and the hospital information systems, the main barriers to its further development. The present state of these systems in international comparison is analyzed through available statistical data and other

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<sup>1</sup> hospital information system (HIS) is a computer system designed to ease the management of all the hospital's medical and administrative information, and to improve the quality of health care. An HIS is an integrating system by vocation, and could also be called an integrated hospital information processing system (IHIPS). Source: Patrice Degoulet, Marius Fieschi, 1999.

<sup>2</sup> The Healthcare Group at Frost & Sullivan

information. Another part of the study utilized semi-structured questionnaire based personal interviews taken with at least three employees of a given hospital (nurse or laboratory assistant, doctor or its assistant, IT-specialist) in August 2009. In the frame of the case study altogether 90 interviews were conducted in 29 hospitals, which represent well the 140 hospitals in Hungary.

The already existent literature contains different aspects of this topic. The study tries to give an overview about these aspects and to complement them with a special focus on the complex health information systems in Hungarian hospitals. Based on the interviews the paper will summarize the main experiences and the future improvements of the hospital informatics.

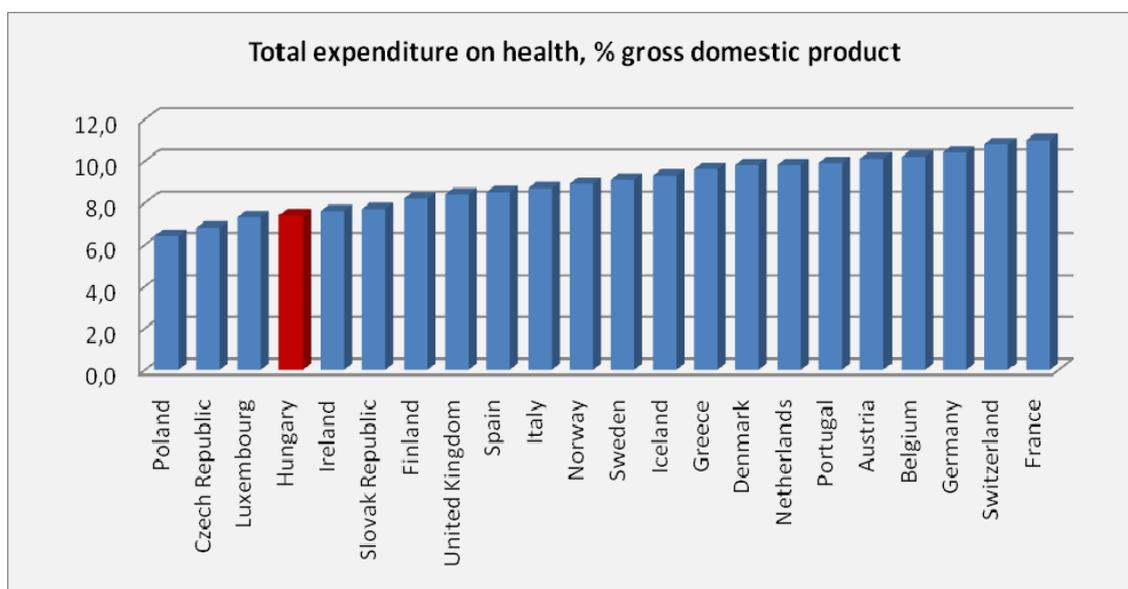
## The examination of hospital information systems in Hungary and in international comparison regarding health and ehealth services

### The importance of health and eHealth field relation to hospital information systems

In recent years the importance of health sector and the cost-effective and secure use of information and communications technologies in support of health and health-related fields are substantial. WHO has identified three overall goals for health systems, such as to be effective in contributing to better health throughout the entire population; to be responsive to people's expectations, including safeguarding patient dignity, confidentiality and autonomy and being sensitive to the specific needs and vulnerabilities of all population groups; and to be fair in how individuals contribute to funding the system so that everyone has access to the services available, and is protected against potentially impoverishing levels of spending.

The proportion of health in GDP is significant in Europe. In international comparison, Hungary's health spending is among the lowest in the OECD after Poland, Czech Republic and Luxembourg<sup>3</sup>.

Figure 1. Total expenditure on health (% of GDP)



Source: OECD 2009,

<http://www.ecosante.org/index2.php?base=OCDE&langs=ENG&langh=ENG>. Portugal and Luxembourg have data only for 2006.

<sup>3</sup> And Korea, but my research is not focus on the countries outside Europe. In Bulgaria the data was 7,2 and in Romania the data was 4,5% in 2006 according to WHO World Health Statistics 2009

The importance of eHealth is also noticeable in recent years. The definition of eHealth according to the World Health Organization is „...the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research...”<sup>4</sup>

ITU defines the potential benefits of e-Health as follows:

- Faster and easier storage, transmission and access to medical data and health-related information for healthcare providers and professionals, citizens/patients, academics, researchers, policy makers and others.
- Capacity building and improved delivery of healthcare services, particularly in rural and remote areas.
- Reduction of operational and administrative costs in implementing healthcare services.

The role of hospital information systems is essential in the development of eHealth services. The level of these services is different in the countries of Europe.

In the European Union the eHealth Action Plan<sup>5</sup> was an important base of the development of national healthcare systems and health information systems, furthermore the i2010 Initiative, the eEurope Action Plan provided basis to the improvements. Now all member states have an eHealth strategy in dedicated documents or as part of wider eServices policies. More and more eHealth became an important element of national health system priorities, which assume the installation of a hospital information system. In Denmark, Sweden and Norway exists fully operational national ICT infrastructures specifically for supporting communications in the health sector. In the EU the priorities of the eHealth varied according to the culture and implemented activities of the country. For example some countries give priority to the Electronic Health Record system, Electronic Patient Records, while the others give priority to the eHealth networks, infrastructure or eCards with the assistance of health informatics.

There are some indicators which can measure and compare the eHealth levels in Europe. In this respect the most important eHealth Indicators are the Euro Health Consumer Index 2009<sup>6</sup> and the Patterns of eHealth use in the EU<sup>7</sup>.

The Euro Health Consumer Index 2009 includes the 27 European Union Member States, plus Norway and Switzerland, the candidate countries of Croatia and FYR Macedonia, and also Albania and Iceland. The index is made up of six sub-disciplines, these are:

1. Patient rights and information (relative weight: 175)
2. e-Health (relative weight: 75)
3. Waiting time for treatment (relative weight: 200)
4. Outcomes (relative weight: 250)
5. Range and reach of services provided (relative weight: 150)
6. Pharmaceuticals (relative weight: 150)

The top 3 countries were Netherlands, Denmark and Iceland with scores above 800. The main causes of Netherlands' excellent healthcare system that it is characterised by a multitude of

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<sup>4</sup> Resolution 58/28 of the World Health Assembly, Geneva, 2005

<sup>5</sup> Commission of the European Communities-COM (2004) 356: Communication from the Commission to the Council, the European Parliament, the eEurope Economic and Social Committee and the Committee of the Regions: eHealth-making healthcare better for Europe citizens: An action plan for a European eHealth Area, Brussels 2004-04-30.

<sup>6</sup> forrás Health Consumer Powerhouse

<sup>7</sup> forrás: Empirica

health insurance providers acting in competition, and being separate from caregivers/hospitals, as well as the country has the best and most structured arrangement for patient organisation participation in healthcare decision and policymaking in Europe. Denmark were good at eHealth, Patient rights and Information, but had a bit lower score in Outcomes. Iceland obtained the third position, due to its location, the country has been forced to build a system of healthcare services, which has the capability of a system serving a couple of million people (which is serving only 300 000 Icelanders).

Some countries also had good results, but other countries are under score 600 (Figure 1.) Romania and Bulgaria had the lowest scores at the Euro Health Consumer Index with the scores 489 and 448, but they are at the stage of assessing their options, choosing a specific direction, so in the future their further development is anticipated.

Hungary is the 20th with the score 633. Hungary fulfilled well in Patient rights and information as well as in waiting time for treatment. However it was bad in eHealth and in outcomes.

**Figure 2. Euro Health Consumer Index, 2009**



Source: Health Consumer Powerhouse, Euro Health Consumer Index 2009.

The patterns of eHealth use in the EU indicator (Figure 3) consist of 3 main aggregates: electronic storage of patient data, computer use in consultation, electronic transfer of patient data. The indicator signs the overall eHealth use with an average index score and with the usage level. The eHealth frontrunners are: Denmark, Netherlands, Finland, Sweden and the United Kingdom. Norway is not an EU Member States, but it belongs to this group.

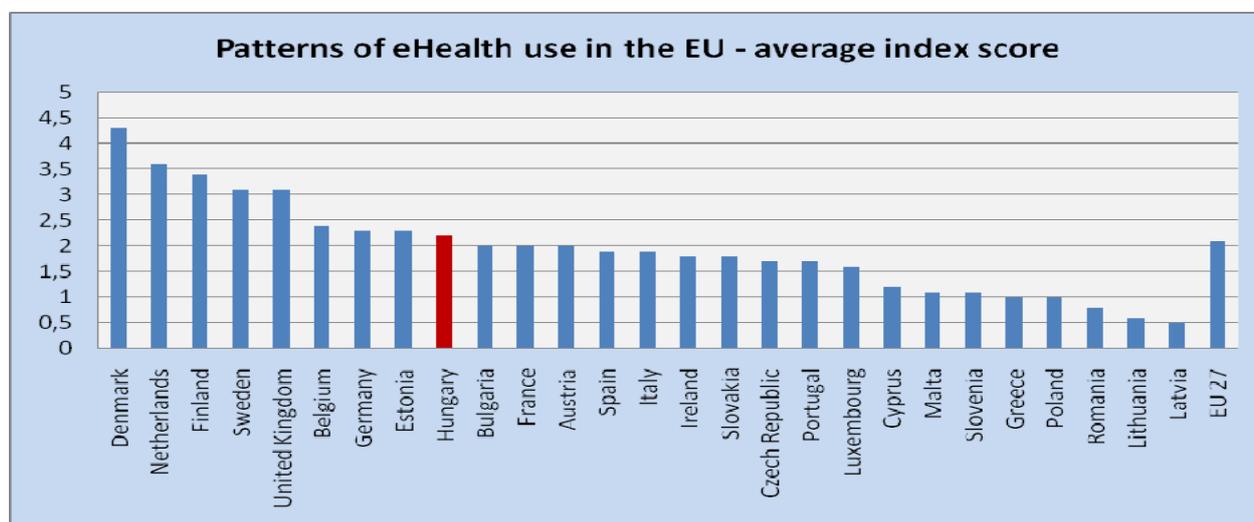
The eHealth laggards, with the lowest scores are: Greece, Poland, Romania, Lithuania and Latvia. The other countries are eHealth average performers. Hungary is fall under the eHealth average performers with 2.2 average index score. In this aspect Hungary has got a better position in Europe, but the electronic transfer of patient data of the country received very low scores.

In Hungary the Ministry of Health and the Ministry of Informatics and Communication play a major role in formulating the national eHealth policy.

The Hungarian Information Society Strategy (HISS) was published in 2002 by the Hungarian Government. From the July 2003, the Hungarian Information Society Strategy – Health and Social Services is available. The eHealth Program was prepared by the Ministry of Health in

2004 on the basis of the health and social information society strategy. The Ministry of Health set up an eHealth Program Management Unit (PMU) under the umbrella of its National Institute for Strategic Health Research<sup>8</sup> in 2004.

**Figure 3. The patterns of eHealth use in the EU**



Source: Empirica, Pilot on eHealth Indicators, 2007.

The development of Broadband network in health care is very important in Europe including Hungary. General eHealth Program including the development of a national health IT framework to comply with the EC eHealth Action plan for Europe (2004-2010).

The development of online services (e.g. healthy living, disease prevention, electronic health record, teleconsultation, preventive information air and water quality information) is also a main challenge of Hungarian eHealth policy.

### Hospital information systems in international comparison

There are various definitions of hospital information systems. Here I use the following definition: hospital information system (HIS) is a computer system that is designed to manage all the hospital's administrative, financial and clinical aspects in order to enable health professional perform their jobs effectively and efficiently.

In the world the first hospital information system were developed in the mid-1960s in the United States and in Europe in a few countries, for example Netherlands, Sweden, Switzerland. The evolution of hospital information systems included the development of large central computers, then the appearance of micro-computers which replaced passive terminals, the implementation of mini-computers, the improvements of workstations and multimedia. The hospital information systems

The HIS of recent years is composed of one or few software components with specialty-specific extension and a large variety of sub-systems in medical specialities, such as Laboratory Information System, Radiology Information System.

<sup>8</sup> <http://www.eski.hu>

Although most hospitals in Europe have some kind of an information system in place, only a few of them have fully integrated and functional hospital information systems solutions installed<sup>9</sup>.

The installation of a HIS in the hospitals is a basic requirement and a necessity and it widely supported by all the various players in the health system. The main international actors of the supply side in the field of health information systems are the followings<sup>10</sup>:

- AGFA: their product Orbis is present on EU market, and it was installed in 37 hospital when they won a tender with the amount EUR 95 million.
- Siemens: they have got several products, but their main product is medico//s, and the i.s.h. med integrated in SAP-environment.
- Nexus: they have a wide health product portfolio from PACS to quality assurance (MEDFOLIO as HIS, MEDICAL MODULES). They have an autonomous module for the psychiatric healing.
- iSOFT: their products are: iClinical Manager, RADCentre, Lorenzo. On their reference list there are 30 health institutions.
- SAP: their system is not a holistic HIS. They have got modules, but to handle the specific health data it is necessary to use other products.
- IBM: the main target group of IBM is the government sector. They have HIS solutions. For example IBM takes part in the development of the Slovenian health insurance system.
- Philips: their IT-development is based on the development of their other health product (radiological, cardiology products). Technological novelty: in 2006 they were pioneers to put in the market the web based PACS<sup>11</sup>. They are good at home care and telecare developments.

Besides these developers there are also local developers focused on a country or a region. For example in Hungary the main national hospital information systems are Hospitaly by Main, Hospnet by Meditcom, MedWorks by Globenet, which can assure the same hospital administrative, financial and clinical solutions than the main actors.

## Hospital information systems in Hungary

The result of the development of Health sector is that the healthcare delivery becomes more and more patient oriented and safer. The use of ICT technologies make it easier to work in the hospitals through the complete health information systems, it facilitates the primary care (in everyday routine for patient management, medical records and electronic prescribing), and also the home care (telemedicine), but telemedicine exists in its initial phase in Hungary, the hospitals measuring devices are used by the patients at home could not connected to the health informatics system of the hospital.

The level of health services and infrastructure differs widely among Hungarian hospitals and even between departments in the same hospital, due to their uneven access to funds.

In the frame of the survey altogether 90 interviews were conducted in 29 hospitals, which represent well the 140 hospitals in Hungary. The survey included hospitals of different sizes, from

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<sup>9</sup> Hospital Information Systems Market in Europe, 2009

<sup>10</sup> ICEG European Center

<sup>11</sup> PACS: a picture archiving and communication systems in medical imaging. It is a combination of hardware and software dedicated to the short and long term storage, retrieval, management, distribution, and presentation of images.

all the seven regions of Hungary, representing different levels of development and interviews were taken in both 'regional' and 'priority' hospitals.<sup>12</sup>

The three main parts of the questionnaire were: general data of the hospital, data and opinion about hospital information systems; use of informatics in cure, and an open part asking for personal opinions about barriers, trends in telemedicine and eHealth in general and in Hungary.

It is true also in case of Hungary that the hospitals have any kind of an information system in place, but only a few of them have fully integrated and functional hospital information systems solutions installed.

The first part of the questionnaire mapped the different types of the used hospital information systems and the possible linkages between systems inside and outside the hospitals.

There are at about twenty different hospital informatics systems in use in the 140 hospitals of Hungary. In the 29 interviewed hospitals 13 different HIS were used, which are usually not compatible information systems.

The two main groups of the Hungarian hospital information systems are:

- The adapted and used foreign complex health information systems, for example: MedSolution (ISH), eMedSolution (ISH), Helise (ÁSZSZ), Clinicom (Siemens)
- Hungarian developments such as: Hospitaly (Main), Hospnet (Meditcom), Infrend (Synergion), MedWorks (Globenet), Meditcom (Meditcom).

Since 1987, when the first laboratory information system was installed in Hungary the developments of hospital information systems started. The two first application was GYOGYINFOK software, which was a free service supported by the Hungarian Government and another DOS based system developed by SOTE (Semmelweis Medical University of Hungary).

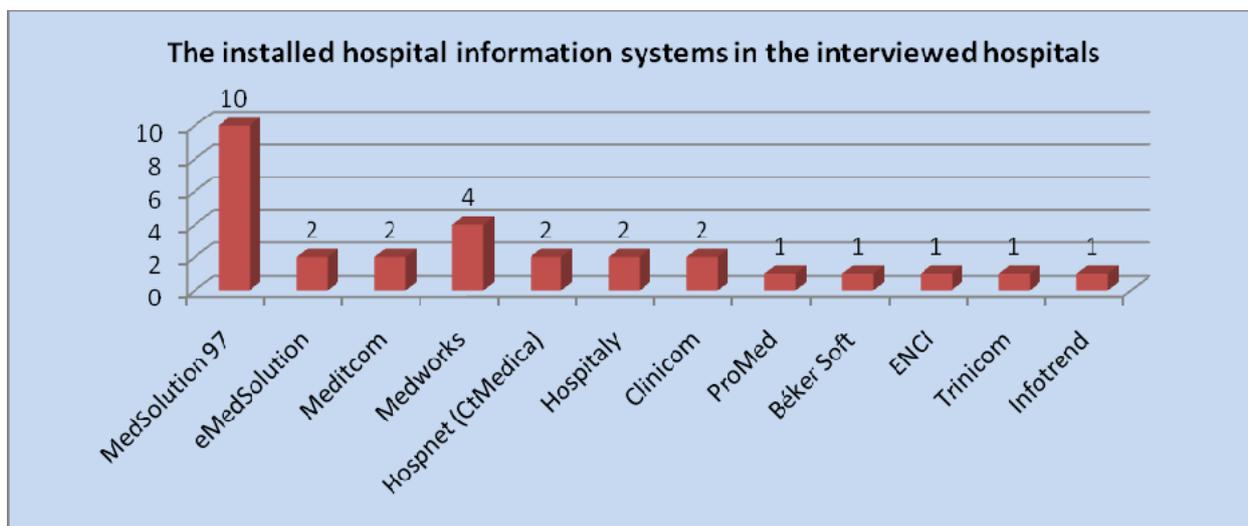
Among the interviewed hospitals the first complex DOS based hospital information systems installation happened in the end of 90' (1997-1999), before these years the hospitals used GYOGYINFOK or SOTE software or another solutions and paper base. The second wave in the implementation of new systems started at the early 2000 (2002-2009), because of the installation of graphic based HIS. In some of the Hungarian hospitals the workers use the systems installed before 2000, nevertheless in other hospitals they use such systems which was installed in 2008 or 2009. The complex HIS has been developed to include all of the basic modules such as: patient records (patient care, out patient care), diagnostic modules (X-ray, UH, CT, MRI, pathology, cytology etc.), patient care modules, basic care modules, family doctor modules.

The most popular health information systems in the examined hospitals were: MedSolution 97 and MedWorks. The users of these systems were usually satisfied, only some specific problems were observed such as delays in informatics developments from the part of the service provider.

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<sup>12</sup> Priority/specialist hospitals provide high quality services for patients with serious or specific illnesses (e.g. treatment of malignant tumours, organ transplantations). They participate in regional level capacity distribution procedures and compete for further contracted capacities across the country. Regional hospitals provide general services. They have an important, intermediary role between priority hospitals and family doctors' practice. These hospitals are obliged for example to do tonsillectomies, to manage childbearing and operate hernia or adenoids. (Source: Hungarian Health Ministry)

Figure 4. Hospital Information systems in Hungary in the interviewed hospitals



Source: interviews in hospitals

In some hospital beside the main hospital information system operates other systems. The hospitals usually do not install all of the modules of the selected HIS. For example in the hospital Jósa András (in Szabolcs-Szatmár-Bereg county) the complex HIS is MedWorks, but the dispensary uses the Phonix system. These two systems do not communicate with each other. MedWorks also had a dispensary module, but the hospital did not buy it, because the workers of the hospital insisted on the extant system, which was the Phonix system. Usually hospitals use a laboratory software beside the existing HIS, but in some cases they use more than 2 systems parallel, which could not communicate with each other and it could results the duplication of working processes.

It is a common problem in Hungarian hospitals that the health information systems cannot collaborate with the management information systems (if the hospital has got one), the controlling system and the economic system in all the time; however the diagnostic system is usually solved inside the hospital. It results delays in the flow of information.

The second part of the survey explored the existing informatics tools in the healthcare and the role of telemedicine.

Almost all of the interviewed hospitals use PCs, laptops, printers, mobiles. Mobile health devices, or POCTs<sup>13</sup> are not typical in hospitals. Some tools are not so popular in Hungarian hospitals and used only by the management, for examples hospital laptop or notebook (basic tools on screening bus), mobile financed by the hospital in most of the hospitals. The opinion of some radiologists was that it would be necessary to have “service” notebooks, because their work is not set to the hospital, so it could be fulfilled from a distance.

The examined hospitals using LAN, and they keep clear of the initialization of Wi-Fi, first of all, because of safety reasons. The other reason against Wi-Fi is the high costs of installation. Among the interviewed hospitals only one of them had Wi-Fi connection, because of their buildings were far away from each other and the big differences between the floors forced them to use it.

<sup>13</sup> POCT- diagnostic tools near hospital beds.

The IT infrastructure is acceptable regarding the number of PCs and printers which is sufficient. IP telephony inside hospital exists in some of the interviewed hospitals. The other mobile devices can be table laptops, Holter monitors for example, is not typical in hospitals, only few of them have some, but the results of these mobile diagnostic tools cannot appear in the hospital information system. POCT is available in 28% of the hospitals and mobile instruments are available only in 18 % of the interviewed hospitals. The role of mobile devices and POCTs increase in the hospitals, but it is in an initial phase in Hungary.

The hospital information systems enable the communication inside a hospital, but it is very limited outside a hospital. Those hospitals are able to get access to information from each other, which form part of the Integrated Hospital Information System (IKIR). Three region of Hungary (Southern-Transdanubia, Northern Great Plain, Northern-Hungary) take part in the IKIR information system. The system allows the access to the health documents, queries of patient data or viewing in case of the patient pertains to one of the IKIR participated hospitals. At the end of 2008 the members of IKIR system amounted to 38 health institutions, 15000 healthcare employees, and 260 family doctor practices. The lack of wider use of IKIR system causes the duplication of medical examinations.

Telemedicine exists only in its very preliminary phase: in more than half of the hospitals measuring devices are used by the patients at home, but these are not connected to the informatics system of the hospital.

The main types of telemedicine are:

- Teleradiology: it provides diagnosis of radiological patient images like X-ray, CT, MRI, from one location to another.
- Teleconsultation: it is a general consultation through an audio-video conference and exchange of patient information for routine chronic disease management (like diabetes, high blood pressure).
- Telecardiology: it provides the observation of a chronic heart patient through monitoring of blood pressure, electrocardiograms (ECG), pulse. A cardiologist can review the data and advice on the condition and initiate any emergency care if required.
- Telepathology: laboratory specimens are viewed, located at a remote laboratory through a camera-based microscope.
- Teledermatology: it provides a remote diagnosis of the patient's skin condition.

The teleradiology and telepathology can be an important field in the future. Based on the interviews (and also the statistics and indicators) in Hungary the teleradiology does not work efficiency, it is an early stage. Static images are available, but only in case of digital radiology. The 30% of the Hungarian hospitals have digital radiology. In the future the lack of radiology specialists of rural areas would be eliminating by the use of teleradiology.

The electronic storage of pathology records realized in 28,6 % of the hospitals.

The telecardiology operates in the 25% of the interviewed hospitals.

Cardio-vascularise tools usually operate offline instead of online. The electronic data record of laboratory health records is possible in most of the hospitals.

The teleconsultation is possible in 21,4% of the interviewed hospitals (but mainly inside the hospital), but the doctors do not use this method generally for communication, because of the lack of IT skills. They use telephone or in some cases emails for consultation in case of long distances. Skype is not allowed in hospitals.

Currently the online registration is not possible in most of the hospitals. Primarily between the family doctor and the hospital there is a possibility for online registration, but very rarely. The

most popular way of registration is the telephone. The hospitals do not prefer the online registration of the patients.

The third part of the questionnaire enabled to meet the opinion of healthcare workers about the existing systems and further developments in the health sector.

The use of HIS could not take out the use of paper, which is not only the fault of the information systems (but the updated regulation of the National Health Insurance Fund Administration of Hungary, OEP). The OEP require the paper form at many medical examinations, other side the obsolete hospital information systems are not capable to print “work list” so the coordination of medical examinations happens on paper basis.

The economizing of the hospitals can effect that they are forced to purchase their other software (which are no health software) in a cost effective way. It means that they work with the OpenOffice.org, but this package is particularly compatible with the Microsoft Office (The HIS solutions prefer the collaboration with the Microsoft products).

The main elements of further developments are:

- Telemedicine, homecare
- Development of health and eHealth services
- Wider use of mobile informatics tools, technologies and mobile visit.
- The improvement of the diagnostic tools (clinical sign and picture)
- Diagnosis and therapy supported by PC
- Electronic patient register systems:
- The improvement of the compatibility of the systems.
- The wide use of digital signature

## **Conclusions**

In conclusion, eHealth is a major policy initiative underlying both the National Health Strategy and the Convergence Programme in Hungary and the development of health information systems is the base of its further improvements.

The result of the development of Health sector is that the healthcare delivery becomes more patient oriented and safer. The use of ICT technologies make it easier the work in the hospitals with the assistance of complete HIS.

The main problems of health sector are the lack of interoperability, the lack of funds and the underperformance of healthcare workers in the field of ICT.

The healthcare organisational structure, the use of information system in hospitals in all European countries is naturally distributed.

Hungarian hospitals use different information systems which cause problems in data and file exchange. The hospital information systems enable the communication inside a hospital, but it is very limited outside a hospital.

The most important thing in the future developments regarding the hospital information systems would be the integration among hospitals in order to assure the information flow. It is essential that the systems could communicate with each other.

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