New approaches to health promotion and informatics education using Internet in the Czech Republic

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Abstract

The paper describes nowadays information technology skills in the Czech Republic. It focuses on informatics education using Internet, ECDL concept and the links between computer literacy among health care professionals and quality of health care. Everyone understands that the main source of wealth of any nation is information management and the efficient transformation of information into knowledge. There appear completely new decisive factors for the economics of the near future based on circulation and exchange information. It is clear that modern health care cannot be build without information and communication technologies. We discuss several approaches how to contribute to some topics of information society in health care, namely the role of electronic health record, structured information, extraction of information from free medical texts and sharing knowledge stored in medical guidelines.

Key words: e-health, e-learning, ECDL, medical guidelines, electronic health record.

Introduction

Modern information and communication technologies have strongly influenced health care. The health care sector has to face enormous acceleration in appearance of new knowledge, in development of new technologies and technical devices, new drugs, as well as spread of new diseases. The patient benefit, professional competence and service excellence can be facilitated by the achievements of information and communication technology. Consequently, the ability to use this technology – computer literacy, seems to become an imperative for health care professionals and other staff involved in health care delivery [1].

What are information technology skills in the Czech Republic? At the end of the year 2003, about 30% of the population was using the Internet. However, one tenth of all Internet users were students, and more than half were less than 25 years old. We are speaking in the European programs about e-accessibility. It is the basic assumption for the future application of e-Health. In the period of 2002-2004 the Czech Republic run domestic online programs as a part of the Action Realization Plan of the State Information Politics. The programs were designed to introduce new information and communication technologies in Czech health care. However, coming from the figures, we can see a local portion of PC-equipped households in the Czech Republic. Now about 13% of the households in the Czech Republic are equipped with a PC. That means a low possibility to introduce the advanced concepts of health telematics to the home care applications.

Nowadays, informatics education using Internet is strongly increasing in Czech universities and other institutions. They organize graduate, postgraduate (doctoral) and long-life education in the field of biomedical and health informatics to fill in the gap. The links between computer literacy and quality of health care as well as the need for computer literacy among health care professionals is obvious. Health care in general is not the fastest in utilizing information technology to its full benefit. Due to new achievements in electronic heath record and telemedicine we can expect great changes in health care services.

Telemedicine contributes very strongly to a new model of health care. Information technologies (IT) start to be a part of professional practice in health care. Patients also have easy access to vast amounts of information and they are encouraged to use it. Use of information technology greatly enhances the

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Received 25.05.2005 Accepted 31.05.2005

access to and flexibility of education; e-learning has become an attractive and cost-effective addition to traditional methods of education and training. Informed and empowered patients are able to be involved in decision making about own treatment. To this environment we introduced some concepts that are actively promoting e-accessibility among patients and health professionals. For example in the Czech Republic the ECDL concept has been applied, new courses, electronic books, web pages and evaluation systems using internet (e.g. ExaME system) have been developed and applied. The research and development under the National Research Plan have been strongly focused on information society in health care. Further we will give more details on some new approaches to health promotion and informatics education using Internet connected with research and education in the Czech Republic and we mention several activities managed by the EuroMISE Center (European Centre for Medical Informatics, Statistics and Epidemiology) in the health oriented research and education (www.euromise.cz).

Informatics Education using Internet

Links between computer literacy and quality of health care as well as the need for computer literacy among health care professionals is obvious. Nowadays, informatics education using Internet is strongly increasing in Czech schools and other institutions. The concept of ECDL has been introduced as one of the tools to assure the quality of informatics education.

The need for computer literacy among professionals has been acknowledged and has been recognised as one of the priorities for developments in the European countries. IT professionals joined in the Council of European Professional Informatics Societies (CEPIS, www.cepis.com) defined the concept of the European Computer Driving Licence (ECDL, www.ecdl.com) based on the results of the European project. The underlying intention was to offer the means of certifying knowledge of essential concepts of IT, and competence in the use of a personal computer and of common computer applications. To reach this goal the ECDL Syllabus defines the term 'computer literacy' and classifies 7 domains (modules) within this term. These are: basic concepts of IT, using the computer and file management, word processing, spreadsheets, databases, presentations, and information and communication. Each module lists the facts to be known and the skills to be mastered for a candidate to achieve the ECDL certification. The ECDL testing was launched in 1997 and has quickly attracted the attention of both the general public and employers in Europe and oversees. In the Czech Republic the ECDL testing started in the year 2001 and has been supervised by the Czech Society of Cybernetics and Informatics (www.cski.cz) [2]. In the year 2004 the number of the issued certificates increased to 5330. Total numbers of indexes, certificates, accredited centres and testers are given in *Tab. 1*.

The ability to manage modern communication tools such as Internet services is one of the most important prerequisites for the development and use of e-education, especially in the lifelong learning. Now we describe the Czech program of postgraduate doctoral studies in Biomedical informatics where

Table 1. **Total numbers of indexes, certificates, accredited centres and testers in the years 2001-2004**

Year	Absolute number	Cumulative number			
	Issued Indexes	Issued Indexes	Issued Certificates	Testing Terms	Accredited Centres
2001	3880	3880	863	966	6
2002	1980	5860	1887	1806	40
2003	3232	9092	3471	2916	65
2004	3905	12997	5330	3281	97

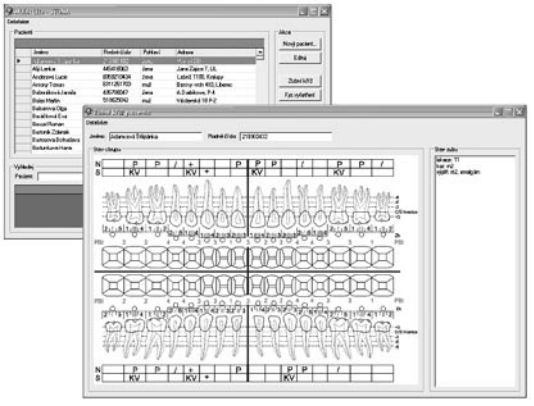
Internet is widely used in education and training activities [3]. The agreement on cooperation of Charles University in Prague and Academy of Sciences of the Czech Republic in postgraduate doctoral studies was signed on April 23rd, 1997. The main goal of this agreement has been cooperation in development and running of joint education and training of young researchers. Based on this agreement the system of postgraduate doctoral studies in biomedicine has been opened (www.kav.cas.cz/pdsb). There is now 19 boards of scientific disciplines in postgraduate doctoral studies in biomedicine, one of them the board of Biomedical Informatics. EuroMISE Centre is the joint workplace of Charles University in Prague, Institute of Computer Science of the Academy of Sciences of the Czech Republic, University of Economy in Prague, General University Hospital in Prague and Municipal Hospital in Caslav participates highly in the biomedical informatics education and training. New teaching methods and tools, based on nowadays information and communication technologies using Internet, have been developed. New books, their electronic versions and corresponding knowledge bases for evaluation of students' knowledge were published in two opened editions Biomedical Informatics and Biomedical Statistics [4-7]. Their electronic versions are available on Internet (www.euromise.cz). Moreover, advanced system ExaMe for evaluation of knowledge using Internet in distant and open education was introduced [8]. Since 2001 the system ExaMe has been regularly used in different courses developed by the EuroMISE Centre. *Fig. 1* shows the screen of the ExaMe test for evaluation of knowledge in the course "Statistics in Biomedical Research". More details about the system ExaMe can be found in [9].

Telemedicine contribution to a new model of health care

The national program of research (NPR) and development in the Czech Republic was elaborated in two foresights organized in the years 2001 and 2003. They significantly helped to formulate the content and structure of the key research topics for NPR. More then 500 experts evaluated various topics independently and set-up their preferences. The detailed SWOT analysis was applied to quantify the results of expert reports and evaluation. The Czech government approved the proposal of the first foresight for NPR in April 2003. The research priorities were implemented in the call for proposals opened in February

Figure 1. **The screen of the ExaMe test in the course "Statistics in Biomedical Research"**

Figure 3. **Application of the MUDRlite in stomatology**

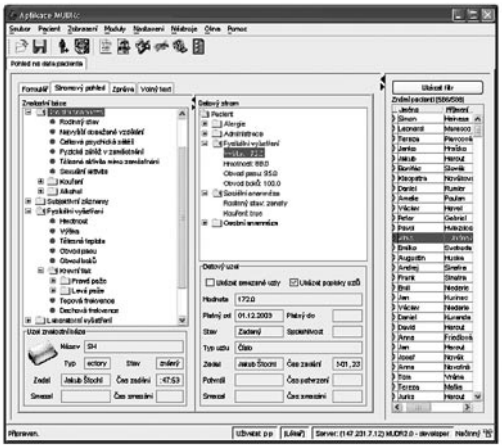


2004 for the period 2004-2008. Several of the core areas covered by IT disciplines were focused on the health care issues directly or the health care domain, where Internet and telemedicine play a very important role.

Let us mentioned objectives of the project "Information technologies for development of continuous shared health care" selected in the first call for proposals of NPR. The project deals with development of methods and technologies for continous shared health care in information society. Remote approach to information (data, knowledge) stored in patient health documentation is the central issue of the project. Electronic Health Record (EHR) is a basic assumption for telemedical applications. The research results on universal multimedia electronic health record have been implemented. In the Czech Republic results of the research on MUltimedia Distributed electronic health Record (MUDR) have started to be exploited [10] in different forms, including applications of PDA. Basic features of the MUDR EHR are:

- Tree level architecture
- Separation of values from description of features (knowledge base)
- Representation using both knowledge base and real values by graph structure
- Unified view on data of any type
- Presentation of data in many languages
- Integration of systems for decision support, e.g. medical guidelines.

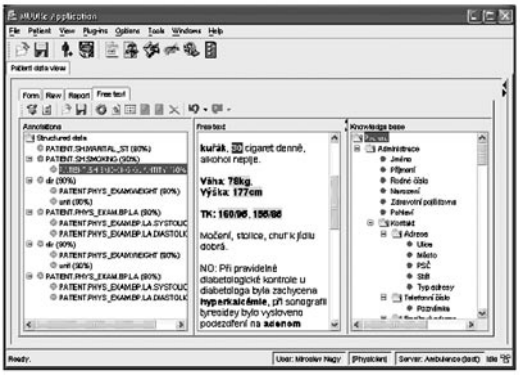
Figure 2. **The screen of the MUDR EHR showing a structured way of storing data**



However, the main objective of the research is to cover the widest area of patient data by structured form, see *Fig. 2*. For applied research it is very important to verify developed methods and technologies in health care practice. MUDRLite application is the direct reaction on topics generated by Czech physicians. For example the version of the MUDR record with applications in stomatology can work on stand-alone workstation without connection with a remote server, see *Fig. 3*. Moreover, proposed solutions can be also verified in two ambulatories of preventive cardiology supervised by both hospitals of the EuroMISE Centre. The project has been also focused on the design and evaluation of a proper infrastructure supporting management of electronic health care documentation and on the development of a health care system for continuous shared care about citizens among various hospitals and general practitioners. One of possible applications is the use of Internet in sharing data among physicians and patients at remote places. We have developed the e-Health portal (www.euromise.cz) where online advice can be given by physicians to patients on distance under valid Czech and European legislative rules of medical data security, safety and privacy. Further issues of continuous shared care are connected with partial automatic structuring of information coved by free text medical record and promoting medical guidelines. Automatic extraction of structured data from medical records written in free text has been done by methods based on analysis using regular rules. Application was tested on medical records from General Faculty Hospital and Municipal Hospital in Caslav [11] and embedded in the MUDR EHR, see *Fig. 4*.

Finally, some knowledge acquired in medicine is possible to represent by medical guidelines, which make decision process in concrete case more easy and transparent. For computer implementation and processing, it is necessary to have medical guidelines explicitly structured. The most important and nowadays mostly used is the GLIF (Guideline Interchange Format) model. The main goal of GLIF is to enable sharing of guidelines among institutions and across computer applications. The GLIF browser is designed as a general tool that can present any formalized medical guidelines in a user-friendly manner. It can be

***Figure 4*. Embedded analysis of free medical text in MUDR EHR**



used for education of students and as a decision support system in medical practice. Our method for automatic comparing of medical guidelines with EHR has the following advantages [12].

General applicability. System based on proposed method can work with arbitrary guidelines. Only at first the guidelines must be transformed into GLIF graph model. The transformation of free text guidelines into GLIF model or some similar structured and precisely defined formal model should be accomplish anyway, because only in this way one can be certain, that guidelines are unambiguous and non-contradictory.

Facilitation of changes in the system. When some part of guidelines is changed, it is not necessary to correct the set of rules used for checking of input data. What is sufficient to do is making corresponding change in guideline model.

Support of distributed computing. The guidelines models can be maintained on a server running at one site and EHR and the system for its comparing with GLIF model and GLIF browser on a user computer.

A method of medical guidelines modelling in GLIF and its implementation in XML have been developed and first version of Processing Medical Guidelines is available on the web pages (www.euromise.cz).

Conclusions

The ability to manage modern communication tools such as Internet services is one of the most important prerequisites for the development and use of e-education (especially in the area of lifelong education) and e-Health applications. The computer literacy and how to prove it, it is a very important task for today. We discussed the role of the ECDL concept for measuring of computer literacy in population. Nowadays, younger groups are more confident in Internet services than the older people. Therefore it is very difficult to implement some e-health application concerning home care, care for elderly or disabled people. However, links between computer literacy among health care professionals and quality of health care are obvious. Everyone understands that the main source of wealth of any nation is information management and the efficient transformation of information into knowledge. There appear completely new decisive factors for the economics of the near future based on circulation and exchange information. It is clear that modern health care cannot be build without information and communication technologies. Telemedicine is largely based on electronic health record and new methods and tools how to structure information, extract information from free medical texts and sharing knowledge is the main objective of many research projects.

Acknowledgement

The work was partly supported by the grant number 1ET200300413 of the Academy of Sciences of the Czech Republic and by the Institutional Research Plan AV0Z10300504.

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