

# International perspectives and initiatives

## Introduction

This feature surveys developments in e-health in Croatia. Josipa Kern, Professor of Medical Informatics at the University of Zagreb, School of Medicine, describes how Croatia has set about creating a modern ICT infrastructure.

This case study, like the others in this series, has some generic messages for librarians:

- Health science librarians need to keep abreast of national and regional e-health strategies and initiatives;
- Librarians have a key role to play in assessing the training needs of clinicians, librarians, students and the general public in the era of e-health; and
- Librarians have relevant skills for teaching both generic information skills and aspects of health informatics. Hence, they should participate in designing education and training programmes and contribute to their teaching.

Jeannette Murphy

## Health and medical informatics in Croatia

*Josipa Kern, Andrija Stampar School of Public Health, School of Medicine, University of Zagreb, Zagreb, Croatia*

## Introduction

Many failures in the health care sector are the result of not having the right information at the right time,<sup>1</sup> owing to a lack of technology or knowledge of how to use it. Although there are many differences between countries, the challenge is to identify common problems faced by both big and small countries, and to search for solutions for managing such problems.<sup>2</sup> The aim of this article

Correspondence: Josipa Kern, Andrija Stampar School of Public Health, School of Medicine, University of Zagreb, Zagreb, Croatia.  
E-mail: jkern@snz.hr

is to survey the past and current uses of information and communication technology (ICT) in the Croatian health and education sectors and see whether this provides the basis for the 'healthy' management of health information.

## About Croatia

Covering about an area of 56 000 km<sup>2</sup>, the Republic of Croatia has about 4.5 million inhabitants. The GNI per capita is \$8060 USD (for 2006) but there are considerable disparities between the 20 counties. Adult literacy is high (98.1% in 2004), and about 10% of persons aged 20 and over have attained a tertiary education (2001 Census). Life expectancy at birth is 75.4 years (2005). Croatia has a total of 802 health institutions, with 512 inhabitants per medical doctor (2005).<sup>3</sup>

## History of ICT in Croatia

Information technology in Croatia began to be used in the business sector in the late-1960s. At the same time some universities began to provide education for future IT professionals. However the real impetus to develop IT came in April 1971 with the establishment of the University Computing Centre at the University of Zagreb. This sought to provide the computer infrastructure base not just for academics but for the whole of Croatia. The first conference promoting IT (Computers at the University, later Information Technology Interface, ITI) was held in 1974 in Zagreb and continues to the present day. Networking of IT capacities started in the late-1980s with two networks, but the real start of ICT in Croatia dates from 17 November 1992 when the Croatian Academic and Research Network (CARNet) was established.

Another milestone in the development of ICT in Croatia was the e-Croatia 2007 Programme whose main objectives were: (i) to enable the state to provide transparent, quick and efficient services to

its citizens;<sup>4</sup> (ii) to provide a comprehensive exchange of information and experience in the business and entrepreneurial world.

Another push towards an information society was the establishment of the Croatian Society for Medical Informatics (CSMI) in 1989 (<http://www.hdmi.hr>). CSMI is a member of the European Federation for Medical Informatics (EFMI) and the International Medical Informatics Society (IMIA).

### ICT in the health care system

The current national strategy for developing the Croatian health system by 2011 identifies complete computerization of the health care system as one of the most important prerequisites for improving the health care system as a whole.<sup>5</sup>

#### History of health care computing

The process of health care computerization in Croatia started in the early-1970s<sup>6</sup> with electronic data processing in the Health Insurance Institute.<sup>7</sup> The Health Centre in the city of Zagreb was a model of electronic data processing for out-patients institutions and the Holy Spirit General Hospital, a model for electronic data processing in hospitals. Chronic disease registers were created for cancer, psychosis, and alcoholism along with hospital registers and trial registries for patients suffering from tuberculosis and diabetics.<sup>8</sup> The first periodic health statistics reports covered morbidity, mortality and the health service.<sup>9,10</sup> The 'Integrated Health Information System' project for Zagreb's health care system<sup>11</sup> was the first systematic approach to computerization. In the late-1980s a similar approach was adopted in the County of Istria for primary health care.<sup>12-14</sup> In the early-1990s Croatia experimented with telemedicine—starting with telepathology and similar applications,<sup>15-22</sup> followed by telemedicine in isolated areas.<sup>23</sup> A number of islands at the Adriatic Sea provided test sites for these trials. In light of the difficulties encountered when building networks and a lack of interoperability between different systems, the need for health and medical informatics standards in health and medical informatics was recognized as a major challenge. Consequently, the Croatian Society for

Medical Informatics initiated the establishment of a local Technical Committee for Medical Informatics (TC 215). HL7 Croatia, initiated and established by the CSMI and the Croatian Medical and Biological Engineering Society (CROMBES), is the second organization responsible for standards in health and medical informatics.<sup>24,25</sup> The Croatian Society for Medical Informatics has organized biannual symposia since 1993.

#### Current status of computerization of the Croatian health care system

The Ministry of Health is committed to developing a national health information system in Croatia. The key drivers behind this decision were previous experience with computerized applications, coupled with a growing understanding of the importance of health information for making appropriate decisions in health care. Health information is used to:

- treat individual patients or population groups;
- plan health care; estimate health problems requiring intervention; and
- ensure the better use of resources.

In 2001 a group of experts, consisting of health professionals, medical informatics professionals, and jurists, was established to start a new project—an integrated national health information system. The requirements for this system were that it should be centralized and cover primary health care (the 'gate keeper' in the Croatian health care system), as well as hospitals (the main generator of expenses in health care). The need for centralization derives from the fact that Croatia has a small population (< 5 million people), and the Croatian Public Health Institute and the Croatian Health Insurance Institute both require reports on health and health service status as well as surveillance of costs. Security and standardization were *sine qua non* requirements for the integrated health information system.<sup>25</sup> The first phase of the pilot project was based in GP offices which agreed to participate, and several hospitals (clinics and general hospitals). After the successful evaluation of the pilot results the hospital part of the project was halted, but the primary health care component continued to develop.<sup>26,27</sup> The primary health care project is designed on two levels, central (kernel of the system)

and local (individual doctor's office). The kernel was run by one vendor, and the local applications were given to several vendors. At the same time a process for certifying local applications was established. The outcome of this process was that several vendors were certified to develop and install their applications in GP offices. All the GP offices holding contracts with the Croatian Health care Insurance Institute were obliged to install one of the certified software systems by the end of 2008. By the end of 2007 about 50% had started the real work by using these applications. Recent information (end of April 2008) indicates that the implementation of these systems is on target to finish by the end of the year.

Croatia is mindful of the importance of a regulatory framework for the computerization of its health care system and several relevant laws have been passed, one of which is the Personal Data Protection Law.<sup>28</sup> In addition, an Agency for Personal Data Protection has been established to ensure compliance with this law. Other important legislation covers issues such as the relationship between electronic and paper documents, digital signatures, and standardization.<sup>29–31</sup> The ethical aspect of personal data protection is covered by the Code of Ethics for Health Information Professionals, passed by the International Medical Informatics Association (IMIA). This was translated by the Croatian Society for Medical Informatics (CSMI) and published on the Website.<sup>32</sup> A document relating to the protection of health information produced by a Working Group is also on the website (<http://www.hdmi.hr>).

Although the hospital part of the 'National Integrated Health Information System' project was halted, hospital directorates have continued to develop and implement particular ICT applications in their hospitals.<sup>32–36</sup>

To maintain progress and to inform the rest of Europe about developments in Croatia, the CSMI and EFMI organized an international meeting (EFMI Special Topic Conference) in 2007 on the island of Brijuni. Four EFMI working groups were represented (Primary Care Informatics, Electronic Health Record, Security, Safety and Ethics, and Nursing Informatics) and organized sessions with participation from local, regional and European speakers.<sup>37</sup>

## Education in ICT

Effective use of ICT, especially new, specialized applications, demands educated developers and end users. Although Croatia has a highly literate population (more than 98%), ICT literacy is not so high. Less than 40% of adults use the Internet; the rate is higher in big cities and among highly educated groups. ICT education in Croatia started in the mid-1970, after the University Computing Centre was established at the University of Zagreb. Before then, only occasional education programs were organized at some high schools and universities.

The E-Croatia Education Programme started in the early years of the 21st century<sup>4</sup> with the introduction of information science into the national curriculum at all levels—from elementary schools through to universities. The development of an appropriate ICT infrastructure was the first step. This involved building of computer classrooms and creating broadband access to the Internet via ADSL from 600 libraries, 700 primary schools, all secondary schools and higher education institutions.

## Health and medical informatics education

IMIA<sup>38</sup> recommends that all health professionals should be acquainted with ICT and be able to use technology responsibly in their daily work. All health professionals should be educated in medical and health informatics and medical informatics should be part of the medical curriculum.

## History

There was very early awareness of the need for health and medical informatics education for health professionals,<sup>6</sup> and formal education for medical students in Croatia began in the early-1970s. Two computer terminals were installed at the Andrija Stampar School of Public Health (School of Medicine, University of Zagreb) by the University Computing Centre for use by students and researchers. Initially, the education programme simply demonstrated to students how computers work and the use of statistical programs for processing medical data. In the middle of the 1980s a computer

laboratory was established, giving students the chance for more hands-on use of computers. Access to the Internet gave more benefits and motivated students to learn how to use ICT. Similar developments occurred at other universities and medical schools in Croatia, but as they started later they were able to build on the experiences of the University of Zagreb. By April 1999, all four Croatian medical schools were using the Internet, and were able to organize the first video-conference on telemedicine for Croatian medical students.<sup>39</sup>

Using the results of a survey on the attitudes of medical staff to health care computerization, the University of Zagreb, School of Medicine, together with the Faculty of Electrical Engineering and Faculty of Science, started a programme of postgraduate education in medical informatics in 1984. The programme was called Health Information Systems. More than 120 students enrolled and about 30% finished the programme by thesis. Most of the students were medical graduates, but there were also pharmacists, mathematicians, economists, librarian and engineers.

For many years Medical Informatics has been included also in the postgraduate curricula of several postgraduate programmes at the University of Zagreb, School of Medicine (for example, Epidemiology, Public health, Occupational Medicine, School Medicine, Family Medicine, Emergency Medicine, Paediatrics, etc.).

### Current developments

Having several computer laboratories at the University of Zagreb, School of Medicine, students and teachers began to introduce e-learning into several subjects (pathology, brain research, physiology, etc.). However, medical informatics and medical statistics are the subjects which make the greatest use of ICT, not just as an educational tool, but also as a way of solving information problems in medicine and health care.

### Graduate study curricula

Medical informatics programmes for medical students start with basic ICT skills as an elective course. In the sixth year of study the aims of the medical informatics component are:<sup>40</sup>

- To familiarize students with the concept and tasks of medical informatics as an interdisciplinary profession that deals with the theory and practice of information processes in medicine, health care and research.
- To increase awareness of the importance of standards, classifications and ethical principles when using ICT in everyday medical and health care practice, with special attention to data and system security.
- To enable students to identify and evaluate data and information flows in health practice and also to ensure they understand the importance of information and ICT support in health care decision making.
- To provide an insight into existing ICT applications, and enable students to assess the appropriateness and usefulness of information systems designed to support patients, public, policy and managers.
- To enable students to find relevant information on the Internet and to assess its reliability.
- To enable students to create a prototype website for a health institution.

The curriculum is delivered through lectures, seminars and practical. (Full details of the programme are available from the author.)

### Postgraduate study curriculum

At present the specialized postgraduate programme in medical informatics at the University of Zagreb is suspended. However, there are several medical informatics courses in other postgraduate and doctoral programmes. These include: Methods in medical informatics, Knowledge discovery in medical domains, Statistical analysis of free text, Health information system management, Simulation modelling, Public health information systems, Bio-signal processing, and Medical image processing.

### How might health science librarians contribute to national e-health programmes?

Although it is unlikely that librarians will participate directly in the computerization of health care systems, they still have an important role to play in implementing national e-health

programmes. First and foremost, as teachers and disseminators of information, they can help prepare future physicians to manage health information. Librarians can provide news alerts on recent ICT-based information sources. They can help to improve information sources (e.g. by incorporating multimedia) and encourage students and health professionals to use such sources. Working in partnership with health informatics professionals, librarians can ensure that health professionals and health authorities are aware of what is happening in the rest of the world. Initiatives to link health systems in different countries (e.g. the newest initiatives in the EU to construct 'patient summaries' and 'e-prescribing') will make it possible to achieve continuity of care in an era of globalization with greater mobility of citizens.

### Conclusion

Starting from the premise that a little step in knowledge and a small piece of information could help in solving big problems, the purpose of this review has been to demonstrate what has been achieved in a small country, Croatia, with respect to computerization of health care, education in using and developing ICTs for health care and medical informatics education for health professionals. Croatia has both a national plan for ICT education<sup>41</sup> and a national strategy for the health care system<sup>5</sup> which includes the goal of greater use of information and communication technologies. The next logical step should be to join these two initiatives to create a Croatian e-health programme which would be compatible with EU e-health strategies. So far Croatia has achieved a high level of computerization in primary care, adopted international standards for interoperability (e.g. HL7, EN 13606, etc.), and begun to train future health professionals in medical informatics skills and knowledge. What is needed now is more cooperation between the health sector (Ministry of Health and Social Wellbeing) and the education sector (Ministry of Science, Education and Sport) to gain recognition that *medical informatics professionals* are needed to develop e-health. This in turn requires educational programs for the new profession based on IMIA's Recommendation and experiences in other European countries.<sup>42</sup>

### Note about the author

Josipa Kern, PhD, Professor of Medical Informatics at the University of Zagreb, School of Medicine (Croatia), is the president of the Croatian Society for Medical Informatics (CSMI), and the national representative to the European Federation for Medical Informatics (EFMI) and the International Medical Informatics Association (IMIA). Her main interests are medical informatics and public health; she has published more than 100 papers in journals and proceedings of medical informatics conferences. She has participated in Scientific Programme Committees and Organizing Committees for several international and national medical informatics congresses and conferences (e.g. Medical Informatics Europe, EFMI Special Topic Conference, IASTED International Conference on Tele-health, Medical Informatics Croatia). She initiated the establishment of the local Technical Committee for standardization in medical informatics (HZN/TC215) and is the president.

### References

- 1 Detmer, D. E. Building the national health information infrastructure for personal health, health care services, public health, and research. *BMC Medical Informatics and Decision Making* 2003. Available at: <http://www.biomedcentral.com/1472-6947/3/1>, (accessed 22 April 2008).
- 2 Murphy, J. International perspectives and initiatives. *Health Information and Libraries Journal* 2007, **24**, 62–8.
- 3 Hrvatski zdravstveno statistički ljetopis za 2005. godinu [Croatian health service yearbook 2005. Zagreb], Croatian National Institute of Public Health, 2006 Available at: [http://www.hzjz.hr/publikacije/hzs\\_ljetopis/index.htm](http://www.hzjz.hr/publikacije/hzs_ljetopis/index.htm), (accessed 27 April 2008).
- 4 E-Croatia 2007 Programme. Available at: <http://www.e-hrvatska.hr/sdu/en/ProgramEHrvatska/Provedba/e-Obrazovanje.html>, (accessed 27 April 2008).
- 5 Nacionalna strategija zdravstva 2006–2011 [National strategy of health care 2006–2011]. Available at: [http://www.mzss.hr/hr/ministarstvo/strategije\\_i\\_planovi/nacionalna\\_strategija\\_zdravstva](http://www.mzss.hr/hr/ministarstvo/strategije_i_planovi/nacionalna_strategija_zdravstva) and <http://www.pharma.hr/download.aspx?file=/Upload/NACIONALNA%20STRATEGIJA%20ZDRAVSTVA.ppt> (accessed 22 April 2008).
- 6 Kern, J. & Strnad, M. [Informatics in the Croatian health care system]. *Acta Medica Croatica* 2005, **59**, 161–8. Croatian.
- 7 Defilipis, B. & Dubokovic, I. Prva iskustva s automatskom obradom podataka u zdravstvu Zagreba (obrada podataka

- zdravstveno neosiguranih) [The first experience with automatic data processing in health care system (population of not health insured)]. *Proceedings of the First Symposium of Applying Computers in Health Care. Zagreb 1971*, 145–51.
- 8 Kulcar, Z., Skupnjak, B. & Strnad, M. Republički registar za rak SR Hrvatske—problemi kompjutorizacije [The Croatian register of cancer—problems of computerization]. *Zdravstvo* 1973, **7**, 46–60.
  - 9 Skupnjak, B. Potreba i upotreba zdravstveno-statističkih informacija na razini samoupravnih društava [Needs and use of health statistical information at the self-organization society level]. *Narodno Zdravlje* 1975, **31**, 371–5.
  - 10 Krajacic, S., Micic, B., Kovacic, L. *et al.* Zdravstveni informacijski system kao preduvjet za planiranje I evaluaciju—elementi za izgradnju, iskustva i perspective razvoja [Health information system as prerequisite for planning and evaluation—elements for building, experiences and perspective of development]. *Materia Socio-medica Jugoslavica* 1978, **1**, 77–8.
  - 11 Dezelic, Gj., Golec, B., Manhalter, T., Milonja, Z. & Strnad, M. Zdravstveni informacijski system grada Zagreba kao preduvjet za sistematično praćenje funkcioniranja zdravstvene zaštite i za njen razvoj [Health information system of the city of Zagreb as a prerequisite for systematical follow-up of the healthcare system functioning and development]. *Materia Socio-medica Jugoslavica* 1982, **5**, 617–25.
  - 12 Dezelic, Gj., Kern, J., Vuletic, S. & Ivankovic, D. Development of health information systems for health centers delivering primary care in distributed environment. *Proceedings of the 7th International Congress MIE 87*. Rome 1987, **1**, 203–8.
  - 13 Kopjar, B., Kern, J., Juresa, V., Ivankovic, D., Vuletic, S. & Dezelic, Gj. A microcomputer based comprehensive problem-oriented medical record system for PHC. *Proceedings of the 8th International Congress MIE 88*. Oslo 1988, 207–11.
  - 14 Kern, J., Bartolic, A., Vuletic, S. & Ivankovic, D. Decision Support System (DSS) in Managing Health Centers. *Proceedings of the 9th International Congress MIE '90*. Glasgow 1990, 305–8.
  - 15 Danilovic, Z., Dzibur, A. & Seiwert, S. Concept of telepathology in Croatia. *Archives D Anatomie et de Cytologie Pathologiques* 1995, **43**, 282–4.
  - 16 Ferek-Petrić, B., Kosi, D., Tonković, K., Lovrić, M., Cifrek, M. & Čikeš, I. Telemedicine in cardiac pacing. *Medicinska Informatika* 1997, **3**, 115–7.
  - 17 Ostojic, V., Stipic-Markovic, A., Tudman, Z., Zivkovic, N., Cvoriscec, B., Trajbar, T., Donnelly, C. L., Grgic, M., Matek, P., Lusic, M. & Iskra, M. A feasibility study of realtime telemedicine in Croatia using Internet videoconferencing. *Journal of Telemedicine and Telecare* 2000, **6**, 172–6.
  - 18 Kovacic, L., Loncaric, S., Paladino, J. & Kern, J. The Croatian telemedicine. *Studies in Health Technology and Informatics* 2000, **77**, 1146–50.
  - 19 Seiwert, S. & Danilovic, Z. The telepathology and teleradiology network in Croatia. *Review. Analytical Cellular Pathology: the Journal of the European Society for Analytical Cellular Pathology* 2000, **21**, 223–8.
  - 20 Vuletic, S. Teleradiology in Croatia. *Journal of Telemedicine and Telecare* 2001, **7**(Suppl. 1), 73–5.
  - 21 Ostojic, V., Cvoriscec, B., Ostojic, S. B., Reznikoff, D., Stipic-Markovic, A. & Tudjman, Z. Improving asthma control through telemedicine. a study of short-message service. *Telemedicine Journal and E-Health: the Official Journal of the American Telemedicine Association* 2005, **11**, 28–35.
  - 22 Ostojic, V., Stipic-Markovic, A., Tudman, Z., Zivkovic, N., Cvoriscec, B., Trajbar, T., Donnelly, C. L., Grgic, M., Matek, P., Lusic, M. & Iskra, M. A feasibility study of realtime telemedicine in Croatia using Internet videoconferencing. *Journal of Telemedicine and Telecare* 2000, **6**, 172–6.
  - 23 Margan, A., Rustemovic, N. & Loncaric, S. [Virtual polyclinic—consultant health service for rural areas and islands]. *Acta Medica Croatica* 2005, **59**, 169–78. Croatian.
  - 24 Kern, J., Strnad, M. & Dezelic, D. [Role of standardization in health care system computerization]. *Acta Medica Croatica* 2005, **59**, 201–7. Croatian.
  - 25 Koncar, M. Implementing the HL7v3 standard in Croatian primary healthcare domain. *Studies in Health Technology and Informatics* 2004, **105**, 325–36.
  - 26 Koncar, M. & Gvozdanovic, D. Primary healthcare information system—the cornerstone for the next generation healthcare sector in Republic of Croatia. *International Journal of Medical Informatics* 2006, **75**, 306–14.
  - 27 Gvozdanovic, D., Koncar, M., Kojundzic, V. & Jezidzic, H. National healthcare information system in Croatian primary care: the foundation for improvement of quality and efficiency in patient care. *Informatics in Primary Care* 2007, **15**, 181–5.
  - 28 Zakon o zaštiti osobnih podataka [Law of protection of personal data]. *Narodne novine* 2003, **103**.
  - 29 Zakon o elektroničkoj ispravi [Law of electronic documentation]. *Narodne novine* 2005, **150**.
  - 30 Zakon o elektroničkom potpisu [Law of digital signature]. *Narodne novine* 2002, **10**.
  - 31 Zakon o normizaciji [Law of standardization]. *Narodne novine* 2003, **163**.
  - 32 IMIA Code of Ethics for Health Information Professionals. Available at: <http://www.imia.org/ethics.lasso>, (accessed 28 May 2008).
  - 33 Majdancic, Z., Jukic, V. & Bojic, M. [Introducing computer units into the reception office as part of the Vrapce Psychiatric Hospital Information System]. *Acta Medica Croatica* 2005, **59**, 179–84. Croatian.
  - 34 Plasaj, T. [Development of information system at Sestre Milosrdnice Clinical Hospital]. *Acta Medica Croatica* 2005, **59**, 213–8. Croatian.
  - 35 Pale, I. [Hospital information system—project of implementation of SAP information system at Sveti Duh General Hospital]. *Acta Medica Croatica* 2005, **59**, 225–32. Croatian.

- 36 Petroveckı, M., Raunic, D., Dubravko, C. & Vukovic, D. [Implementation of integrated hospital information system in the existing hospital organization—experience at Dubrava Clinical Hospital in Zagreb]. *Acta Medica Croatica* 2005, **59**, 219–24. Croatian.
- 37 Bryden, J., de Lusignan, S., Blobel, B. & Petroveckı, M. (eds). Proceedings of the EFMI Special Topic Conference 2007, Brijuni (Croatia), 1 May–30 June 2007.
- 38 IMIA. Recommendation on education in medical informatics. *Methods of Information in Medicine*, 2000, **39**, 267–77.
- 39 Videoconference on telemedicine for medical students. Available at: <http://cn.carnet.hr/arhiva/1999/990428telemedicina/index.html>, (accessed 27 April 2008).
- 40 University of Zagreb, School of Medicine. Program i plan predmeta medicinska informatika. [Medical informatics curriculum]. Available at: [http://www.snz.hr/cms/index.php?option=com\\_content&task=view&id=125&Itemid=74](http://www.snz.hr/cms/index.php?option=com_content&task=view&id=125&Itemid=74), (accessed 27 April 2008).
- 41 Operativni plan provedbe Programa e-Hrvatska 2007. za 2006. godinu [Operating plan of e-Croatia Programme 2007 for year 2006]. Available at: [http://www.e-hrvatska.hr/repozitorij/dokumenti/downloads/plan\\_provedbe\\_e-Hrvatska\\_za\\_2006.pdf](http://www.e-hrvatska.hr/repozitorij/dokumenti/downloads/plan_provedbe_e-Hrvatska_za_2006.pdf), (accessed 27 April 2008).
- 42 Jaspers, M. W., Ammenwerth, E., ter Burg, W. J., Kaiser, F. & Haux, R. An international course on strategic information management for medical informatics students: international perspectives and evaluation. *International Journal of Medical Informatics* 2004, **73**, 807–15.