

Using Routine Health Information Systems for Well Designed Health Evaluations

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Abstract

In 1984, Peter Reichertz gave a lecture on the past, present and future of hospital information systems. In the meantime, there has been a tremendous progress in medicine as well as in informatics. One important benefit of this progress is that our life expectancy is nowadays significantly higher than it would have been even some few decades ago. This progress, leading to aging societies, is of influence to the organization of health care and to the future development of its information systems. Twenty years later, referring to Peter Reichertz' lecture, but now considering health information systems (HIS), two questions are discussed: which were lines of development in health information systems from the past until today? What are consequences for health information systems in the future?

The following lines of development for HIS were considered as important: (1) the shift from paper-based to computer-based processing and storage, as well as the increase of data in health care settings; (2) the shift from institution-centered departmental and, later, hospital information systems towards regional and global HIS; (3) the inclusion of patients and health consumers as HIS users, besides health care professionals and administrators; (4) the use of HIS data not only for patient care and administrative purposes, but also for health care planning as well as clinical and epidemiological research; (5) the shift from focusing mainly on technical HIS problems to those of change management as well as of strategic information management; (6) the shift from mainly alpha-numeric data in HIS to images and now also to data on the molecular level; (7) the steady increase of new technologies to be included, now starting to include ubiquitous computing environments and sensor-based technologies for health monitoring.

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As consequences for HIS in the future, first the need for institutional and (inter-) national HIS-strategies is seen, second the need to explore new (transinstitutional) HIS architectural styles, third the need for education in health informatics and/or biomedical informatics, including appropriate knowledge and skills on HIS. As these new HIS are urgently needed for reorganizing health care in an aging society, as last consequence the need for research around HIS is seen. Research should include the development and investigation of appropriate transinstitutional information system architectures, of adequate methods for strategic information management, of methods for modeling and evaluating HIS, the development and investigation of comprehensive electronic patient records, providing appropriate access for health care professionals as well as for patients, in the broad sense as described here, e.g. including home care and health monitoring facilities.

Comparing the world in 1984 and in 2004, we have to recognize that we imperceptibly, stepwise arrived at a new world. HIS have become one of the most challenging and promising fields of research, education and practice for medical informatics, with significant benefits to medicine and health care in general.

Keywords: *health information systems (HIS), health evaluation.*

Introduction

“Hospital information systems have been in existence for almost two decades now. Therefore, it is possible to speak about their past. This contribution is intended to examine some of the features, which we could observe during this evolution, and it intends to project some of the present observations into the future”.

The text quoted here is from the year 1984. Twenty years before this, EuroMISE 2004 conference at Prague, Professor Peter Reichertz (1930—1987) gave in Brussels an outstanding lecture on “hospital information systems—past, present, future” ([1]; among others referring to the work of Ref. [2]; see for a more recent publication of the author [3,4], see also Refs. [5—7]). Due to various reasons, I want to pick up this topic. It is slightly modified, as I will today, 20 years later, talk about the past, present and future of health information systems. The main reason for selecting this topic is that, not only in my opinion, this field is one of the brightest, most challenging and most promising fields of research, education and practice for medical informatics, with significant benefits and consequences for medical statistics and epidemiology, and to medicine and health care in general.

Health information systems and hospital information systems

Such complexes or systems of processing data, information and knowledge in health care environments I will briefly call health information systems (HIS, for more precise definitions see Ref. [18], pp. 26—33). So, hospital information systems are just one instance of health information systems, with a hospital as health care environment, respectively, health care institution. The aim of health information systems was and is as simple as relevant: to contribute to a high-quality, efficient patient care (e.g. [18], p. 30). This aim is primarily centered towards the patient, so it is a patient-centered approach and towards medical and nursing care, and the administrative and management tasks needed to support such care.

The relevance of ‘good’ HIS for high-level quality of care is obvious (e.g. [18], pp. 1—2), as without having appropriate access to relevant data, practically no decisions on diagnostic, therapeutic or other procedures can be made, with fatal consequences for patients. But HIS are also an important cost factor. Approximately, 10% of the gross domestic products of

nations are devoted to health care, and approximately 5% to information and communication technology (ICT). The health care ICT industry has achieved considerable economic relevance (e.g. [18], pp. 1—9). Tendencies in increasing investments in health and in ICT, particularly in developed countries, can be expected. Having this in mind, we can recognize the relevance of systematically processing data, information and knowledge for the quality and efficiency of health care. Progress in the field of health information systems is rather directly correlated with more quality and efficiency of care, where “with more efficiency of care” may in future mean that care will remain affordable.

Let me briefly mention one example, pointing out the direct relationship of quality of HIS and quality of care, I had to deal with during my work at the Heidelberg University Medical Center (taken from Ref. [18], pp. 17—19). Imagine the following situation: Ursula B. was pregnant with quintuplets. She had already spent more than 5 months in the Heidelberg University Medical Center. She had to spend most of this time lying in bed. During the course of her pregnancy, her physical problems increased. From the 28th week on, she suffered severe respiratory disorder.

The pediatrician, who was also involved in her treatment, had the following question: what are the chances of the infants being born healthy at this gestational age? He went to a computer, a ‘health care professional workstation’ available on his ward and in his office. Such a workstation can be used for a variety of tasks. It is connected to the computer network of the Heidelberg University Medical Center. The physician called up a ‘medical knowledge server’ and one of its components, a bibliographic database (MEDLINE). This database contains the current state of the art of medical knowledge worldwide. The medical knowledge server can be accessed at any time and from any of the more than 3000 health care professional workstations of the Heidelberg University Medical Center.

The following information resulted from this consultation of the medical knowledge server. Several publications stated that only slim chances exist for all infants to survive in good health. If they are born during the 28th week of pregnancy, the chance for survival is about 15%. In case of birth during the 30th week, their chances would improve to about 75%. Also, according to the literature, further delay of the delivery does not improve the prognosis of the quintuplets. The physician discussed the results with the expectant mother. Despite her respiratory problems, she had the strength to endure 2 more weeks. On January 21st, 1999, the quintuplets were born well and healthy at the Heidelberg University Medical Center. A team of 25 physicians during the delivery.

At that time, it was one of the first installations of its kind in the world. Nowadays, through global access to knowledge and through our networking capacities, such features can be implemented at low cost in every health care setting and can be used at any time at the health care professional’s workplace.

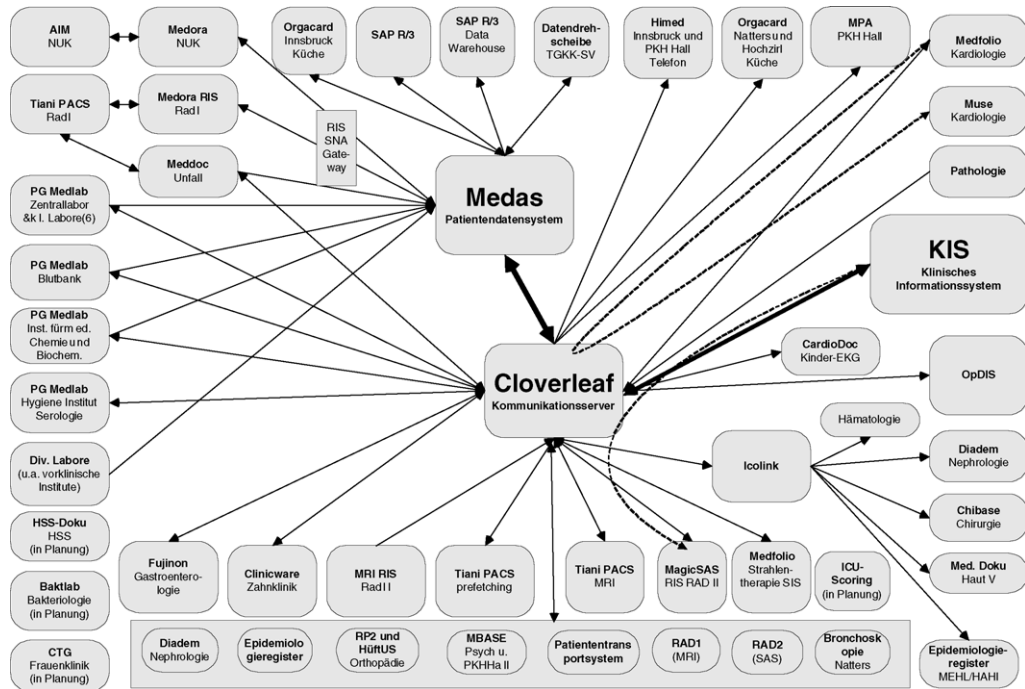


Fig. 1 Example of a visualized information system architecture, here of the computer-supported part of the information system of the Innsbruck University Medical Center from 2002 ([34], p. 31), using the three-level graph-based meta model (3LGM, [35,36], see also Ref. [37]), here to describe the so-called logical tool layer.

In the meantime (since June 2003), documents of the electronic patient record including, e.g. discharge summaries, radiological images or lab results of the TILAK hospitals are available globally to health care professionals via special secure web services. This gives us the opportunity in particular to support patient-centered care in the Tyrol and related German, Italian or Swiss regions, beyond the limits of one health care institution and even beyond the limits of a nation. An outline of the health information system architecture.

Summarizing the HIS development

Comparing our globe at the time of Peter Reichertz in 1984 and the one we are living in today in 2004, we have to recognize that we i]tibly, at a new world. Peter Reichertz

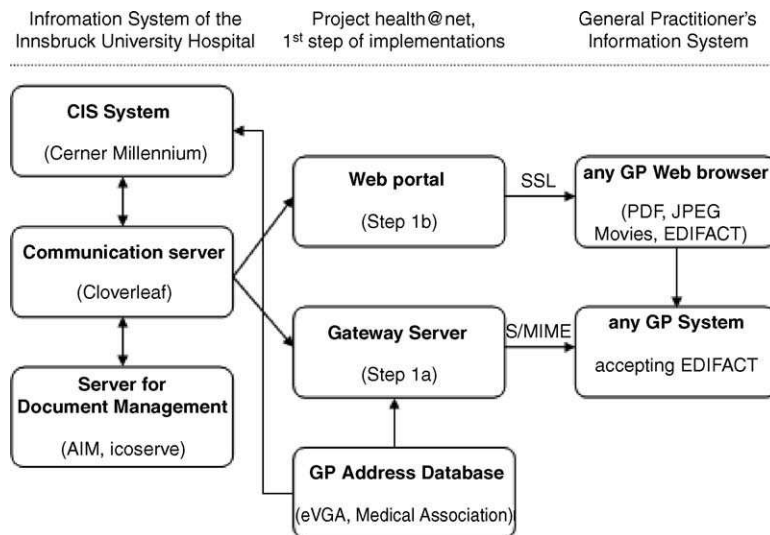


Fig. 3 Logical tool layer of a three-level graph-based meta model (3LGM) of relevant health@net system components. Medical documents from the clinical information system (CIS, in Fig. 2 denoted as KIS) are addressed to their receivers (according to the eVGA-Server, an LDAP address directory which is hold by the Austrian Medical Association) and transferred either to a gateway server (which delivers the documents directly into an inbound directory of the GP- system over the commercial health care networks, step 1a) or onto a server for document management which provides the files for a secure Web portal (step 1b) and the GP's Web browser also directly into the inbound directory of the GP-system.

Conclusions:

Let me summarize. Modern information processing methodology and information and communication technology has strongly influenced our societies, including their health care. Twenty years after Peter Reichertz'lecture on the past, present and future of hospital information systems [1], we can recognize that institution-centered hospital information systems are developing towards regional and global health information systems, with new, strongly extended functionalities and tasks.

As a consequence, more than ever, medical informatics is needed for an efficient development and strategic management of these new health information systems. Having the possibility of doing research and education in this field, or to contribute to its practice is a great opportunity and responsibility, as it gives the chance to contribute to the quality and efficiency of health care at a very prominent place. Twenty years after Peter Reichertz talk, we may redefine the aim of health information systems as to contribute to a high-quality, efficient health care, now for patients and consumers and for medical research.

Health information systems have to be developed and explored that enhance opportunities for global access to health services and medical knowledge. Informatics methodology and technology is expected to facilitate continuous quality of care in aging societies. Ubiquitously available computing resources and networks, existing worldwide for the transmission of all varieties of data, will allow us to consider new types of information systems for health care, including new kinds of health monitoring and also new opportunities for the analysis of biomedical and health data. These transitional information system architectures and infrastructures will, when appropriately designed and adequately strategically managed, provide new opportunities for the whole field of biomedical and health informatics as well as

of biomedical statistics and epidemiology and economical constraints, she was always a promoter of our field, convinced that good science and good education in medical Informatics, statistics and epidemiology will contribute to better health and to the progress of the sciences. Her scientific achievements and her achievements here at Prague are really outstanding.

Because of this reason, the University for Health Sciences, Medical Informatics and Technology (UMIT) at Innsbruck, Austria, decided to honor Professor Zvarova with its University Medal. Let me quote from the certificate: for her outstanding achievements in the field of Medical Informatics, Statistics and Epidemiology, the executive board of UMIT has decided on January 14th, 2004, to award the University Medal of UMIT to Prof. RNDr. Jana Zvařova, DrSc., Director of the European Centre for Medical Informatics, Statistics and Epidemiology (EuroMISE Centre) of Charles University Prague and Czech Academy of Sciences, to be handed over during the International Joint Meeting EuroMISE 2004.

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