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History of Medical Informatics in Europe - a Short Review by Different Approach

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Review
ABSTRACT
The panel intended to collect data, opinions and views for a systematic and multiaxial approach for a comprehensive presentation of "History of Medical Informatics", treating both general (global) characteristics, but emphasizing the particular features for Europe. The topic was not only a subject of large interest but also of great importance in preparing a detailed material for celebration of forty years of medical informatics in Europe. The panel comprised a list of topics, trying to cover all major aspects to be discussed. Proposals of staging the major periods of medical informatics history were also discussed.
Key words: medical informatics; health informatics; e-health history; medical informatics education; EFMI; IMIA.

1. INTRODUCTION–OBJECTIVES

The aim of this panel was to enlarge the involvement of the EFMI community in preparing the 40th anniversary of EFMI in 2016 and the 50th of IMIA in 2017 and also to identify the pioneering activities in EFMI countries and all potential sources of data.

But, a comprehensive presentation of the history of Medical Informatics (MI) required a systematic and multiaxial approach, to provide not only a list of events, journals, organizations or people, but also to analyze the characteristics of each epoch, to reveal the trends and to recall both successes and failures.

By offering such a dynamic view, the "history" became a tool for a realistic estimation of the impact of medical informatics on various domains–healthcare, computer science, industry, education, even on our daily life.

2. PANEL DESCRIPTION

The scientific content of the panel consisted of a set of nine presentations from outstanding scientists, with personal contributions to the development of MI (1-14). They approached, from different angles, various aspects of the evolution of this domain. The introduction came from a member of the EFMI founding team (Barry Barber). Then the evolution of ideas, seen from an academic point of view (Jan H van Bemmel) but also from the level of European Commission (Diane Whitehouse) were presented, followed by a reflection of this evolution in medical informatics education (Arie Hasman). An illustrative example followed about how the actions at a national level (Jana Zvarova) had an echo at European level. Nevertheless, the history of MI. in Europe can only be well understood within the global context, which was the focus of the last part of the panel. First, a view of the importance to learn from history for shaping the future (Marion Ball), followed by two independent attempts to define major stages in the evolution of medical informatics with their general characteristics: one mostly oriented on the evolution of concepts and organizational impact (George Mihalas), the other mostly oriented on the evolution of technologies and applications (Izet Masic). The panel ended with a presentation of the History project of IMIA (Casimir Kulikowski) (Figure 1).

2.1. Looking Back on Fifty Years of Medical Informatics (Barry Barber and Maureen Scholes)

Based on the materials sent by Barry Barber (included in this volume as a separate article), the chair of the panel presente the story of EFMI foundation, within the context of the enthusiastic 70's development of IT applications in all areas, including healthcare. Comments

about expectations from medical informatics in those early stages offered a more comprehensive picture of this pioneering era in Europe (1).

2.2. Evolution of people and ideas in Medical Informatics (Jan H van Bemmel)

In the past decades we have seen major changes in medical informatics. Some reasons for it were that nobody was able to predict the advent of the personal computer in the 1970s, the world-wide web in 1991, followed by the rapid rise of the Internet, and the spread of the social media in this century. Foremost, however, nobody expected that it wouldn't be primarily the hardware or the software, but that human factors would become crucial for the successful applications of computers in health care (2, 4, 5).

Figure 1. Diane Whitehouse, Izet Masic, Arie Hasman, Casimir Kulikowski, Jana Zvarova, George Mihalas (chair), Marion Ball and Jan van Bemmel in Prague, April 2013, as panelists about Medical informatics history (from left to right).

In the past, sometimes unrealistic expectations were held, e.g., regarding medical decision-support systems, or the use of electronic patient records. Although the technology was widely available, some applications in health care appeared to be far more complex than expected. Health care processes can seldom be fully standardized. This holds even more for individual patients and their diseases. Humans take part at least in two very different roles in the loop of information processing: as subjects, delivering patient care, and as subjects that are the objects of care–the patients. Besides, medical informatics lacks a specific methodology; all its methods were borrowed from neighboring disciplines such as physics, mathematics and, of course, computer science. Also human factors play a major role in applying computers in health care. Everyone pursuing a career in biomedical informatics needs to be very aware of this.

It is to be expected that patients and their relatives will request an increasing role in using computers for health. There is also a strong demand to use the computer for the assessment of the quality of health care. All this implies that research in medical informatics is much more challenging than thought in the past.

2.3. EC eHealth visions (Diane Whitehouse)

When looking back 50 years, it can also be exciting to peer into the future by several decades.

Current European policy documents already look ahead, mostly to 2020. All current policy initiatives are firmly embedded in the notion of what a commitment to the EU2020 agenda can offer. Each of the seven flagship initiatives involve a set of coherent, comprehensive, actions that are intended to bring these aspirations to fruition. Several of these flagships can either support or offer a response to the challenges of active and healthy ageing, and enhancing a sense of well-being.

The second variant of Europe's eHealth action plan, published in December 2012, therefore faces forward to 2020. Its content was already indicated in some ways by the ideas of the European Union's 2012 task force on eHealth. Lying ahead are potential interpretations of European policy development in 2030, 2040 and even up to the Digital Futures of 2050: they already include visions of healthy lifestyles supported dynamically by information and communication technologies.

In 2013, together with Magda Rosenmoeller (IESE, Spain) and Petra Wilson (CISCO, Belgium), Diane Whitehouse was editing a book aimed at providing an update on eHealth in Europe.

The volume reviewed the current state-of-the-art in European eHealth developments, yet started by tracing the history of European eHealth and its advances and challenges. It describes best practices as well as challenges, offers a voice to stakeholders, and examines the future eHealth market in the European Union.

It concludes with a vision for the future. The book brings together 25 chapters written by more than thirty leading experts and corporate executives in their respective eHealth fields. All are encouraged to cite past and contemporary case studies. Looking ahead, it provides their insights and visions of eHealth tomorrow.

2.4. An abridged history of medical informatics education (Arie Hasman)

Medical informatics education started in the seventies of the last century. Medical informatics was considered by some as applied informatics, others were of the opinion that medical informatics was more than informatics and medicine together and therefore considered it as a discipline separate from informatics. In both cases the 'end product' of these types of education was considered to be a professional not being a medical

professional (although these new professionals could initially have been educated as a medical specialists). In 1973 an invitational workshop was held at the Reisensburg near Ulm, Germany where the above noted opinions were expressed. The purpose of the workshop was to define approaches to education in medical informatics. This workshop resulted in the Reisensburger Protocol that pointed out the way in which medical informatics should be taught.

In addition the idea became more widespread that medical informatics also had to be taught to medical students (e.g. in the USA the GPEP (General Professional Education of the Physician and College Preparation for Medicine) 'Physicians for the Twenty-First Century', or the Dutch approach to medical informatics). In the Netherlands there were even three possible different approaches in teaching informatics: as part of a program in a specific discipline (as was done in medicine where medical informatics was introduced in the curriculum, as a specialization of a discipline with up to 30% informatics in its curriculum and an applied informatics program that focused on a specific discipline, like medical informatics.

In the past a number of conferences were held about experiences in medical informatics education. During these conferences the various programs showed what topics they included in their curricula or the curricula of other disciplines. The IMIA working group on education developed a database in which the characteristics of programs in medical informatics were stored and could be viewed. Also in the European Commission stimulated education in MI by funding the (IT)-EDUCTRA projects and the Nightingale project. It became time to make recommendations about how curricula in medical informatics should be organized (3). In 2000 the first international IMIA Recommendations on education in medical informatics were published. In 2010 the first revision was published. The Recommendations have been widely used.

A last development is the accreditation of programs. This year three programs were accredited by IMIA. In the panel the above mentioned developments will be further discussed.

2.5. Medical Decision Support and Medical Informatics Education: Roots, Methods and Applications in Czechoslovakia and the Czech Republic (Jana Zvárová)

The history of medical informatics in Czechoslovakia and the Czech Republic was described, with a focus mainly on the topics of medical informatics education and decision support methods and systems. Several conferences were held in Czechoslovakia and in the Czech Republic, organized in cooperation with IMIA or EFMI. The first IMIA conference held in a socialist country was organized in Prague, Czechoslovakia in 1985. The proceedings covering selected full papers titled Diagnostic Strategies and Expert Systems were published by the Elsevier, North Holland (4). The Velvet Revolution in Czechoslovakia, provoked by a students' strike on November 17th, 1989, opened the door for cooperation in science and education with a number of countries in the world. In 1990s medical informatics topics were further developed in education and decision support tasks on the national level and in an international cooperation. The second IMIA conference in Prague in 1990's focused on medical informatics and medical education. It brought together participants from 18 countries from all over the world and the proceedings Knowledge, Information and Medical Education, published by Elsevier in 1991 (5, 6). Support of several European and national projects focused on medical informatics topics also highly contributed to medical informatics development in the Czech Republic. In 1994, two European projects contributed to the foundation of the European Center for Medical Informatics, Statistics and Epidemiology, EUROMISE, as the joint workplace of Charles University in Prague and Academy of Sciences of the Czech Republic that has been further developing the field of medical informatics in the Czech Republic (6).

2.6. Back to the Future: What Can We Learn from History (Marion Ball)

The presentation was inspired from the keynote speech at Medinfo 2010 in Capetown (7). For framing the problem, the presentation started, in a critical but realistic view, with some examples, revealing that newer, more sophisticated and more expensive methods are not always better! A deeper view revealed that, while health information technology worked well in clinical applications such as those which involve laboratory and image data, but for primary care or internal medicine or other more complex clinical environments, the introduction of computer technology has often added to the clinician's time and work. A major challenge of HIT, then, is to develop systems that actually save time, and simplify work, rather than the opposite. Other challenges, like a new type of medical error, which frequently arises due to the involvement of computer systems, or the fragmentation of medical care and the intrusion of administrative and bureaucratic managers to deal with billing and insurance, which often contribute to the unsustainable growth in costs of healthcare. The benefit of such a view is the understanding that these problems can be addressed by reengineering health care systems, while recognizing that not all change requires IT for success and that health IT needs to capitalize on innovations by developing intelligent software tools that can help reduce, rather than increase costs.

2.7. Evolution of concepts in Medical informatics (George I. Mihalas)

The classical way to present a "history" is to list major events in a chronological order, with more or less detailed comments about the persons, ideas or events. A distinction between periods brings a systematization flavor, easing the comments. We can distinguish the following stages in the development of medical informatics (8):

- Early stage: (up to ~1975): pioneering work of sci-

entists, major work on: signal analysis, laboratory applications, first attempt on decision support, databases, modeling and simulation of biological processes, biostatistics

- M.I. "childhood/youth" (~1975–~1990): founding national and international organizations, conferences, attempts to systematize major areas of MI, first specialized schools, development of methodologies, patient records, health information systems (HIS), advanced decision support–expert systems

- Consolidation period (~1990–~2000): MI consolidates its position as independent discipline, it became clear that the object of study is "medical information" (not computer applications); implementation of hospital information systems, new chapters (imaging, telemedicine); substantial funding for e-health research start, more visible the complexity of EHR, including confidentiality, data protection, standards etc.

Figure 2. Jana Zvarova and Casimir Kulikowski, co-chairs of Panel about History of Medical Informatics in Prague, April 2013

- Maturity of MI. (~2000–~2010): clearer understanding of e-health potential to address major challenges of present healthcare, internet impact on medical applications; involvement of politicians, extension of regional/national projects, e-health as business, patient-centered MI., new keywords: integration, interoperability, consumer informatics; awareness on difficulties in real implementation of HIS, "failures" reported; analysis of "barriers", quality assessment, clear contour of sub disciplines: bioinformatics, neuroinformatics, VPH (Virtual Physiological Human) etc.

- Full integration of MI in Medicine and Healthcare (~2010–~2020): increased user acceptance, generalization of EHR / EMR, inclusion in HIS, vertical integration data (molecular/cellular/genetic up to organ/system and whole body, horizontal integration (primary care, specialized ambulatory and hospital data), full interoperability, patient empowerment, visible steps towards "personalized medicine", increase patient safety, preventive medicine, use of portable devices, home monitoring systems, tele-assistance, intensive use of web facilities.

2.8. Staging medical informatics (Izet Masic)

The Medical informatics is the foundation for understanding and practice of the up-to-day medicine. Its basic tool is the computer, subject of studying and the means by which the aspects and achieve the new knowledge in the studying of a man, his health and disease, and functioning of the total health activities (9). For the last fifty years of Medical informatics development the five time period are characteristic:

- First period (1955-1965): experimenting, and the studying of the new technologies in the medicine, automatic medical decision making, use of computers in biostatistics, automatic analysis of electrocardiograms, health information systems, computerization of clinical laboratories

- Second period (1965-1975): solutions for automatized data processing, hospital information systems, medical equipment with built in computers, new biomedical engineer disciplines, new diagnostic methods and therapeutic procedures based on microprocessors, the computer tomography, computer assisted medical decision

- Third period (1975-1985): significant progress of computer technique development, the interest for education by health workers grew, important congresses were organized, software packages on market, with significant commercial effects; appearance of personal computers with perfected technical performances, especially memory, intensive application of personal computers

- Fourth period (1985-1995): standardization of knowledge; intensive research on improvement of methods and technique of artificial intelligence, expert system in medical diagnostics and therapy; intensive connection of hospitals with private doctor surgeries

- Fifth period (1995-present): development of medical informatics cannot be separated from development of computer technologies; integration of informatics methods into medical segments in health care work sites, improvements of hardware and software technologies, mostly in the domain of projecting on basis of high quality language of the fourth and fifth generation of computers; expansion of the use of microprocessor technology in the diagnostic systems, informatics methods in doctor surgery, building of informatics equipment, instrumentation and prostheses.

2.9. IMIA 50th Anniversary History Project and the Prototype Rutgers History Informatics System (Casimir A. Kulikowski)

Developing informatics tools to support the writing of the history of biomedical and health informatics is an important endeavour given the approaching 50th Anniversary of IMIA in 2017. The need is to archive, index, and produce readily accessible recollections from the pioneering days of our field. The Rutgers History Informatics project has developed a MediaWiki to experi-

ment with ways of collecting, indexing and visualizing the materials that related to the evolution of IMIA. The wiki allows access to documents, biosketches and short descriptions of historical events for IMIA, together with timeline summaries which place them in context. The prototype system will be augmented with audio material, and will serve as an archival repository for historical research, including software tools for text analysis and extraction of the information that can be used by authors contributing to the 50th Anniversary IMIA History, which is planned as an edited volume of contributions from all world regions and societies that are members of IMIA. Contributions to the IMIA History Project are already being published as articles in the IMIA Yearbook (2, 10, 11, 12, 13). The analysis of materials on the MediaWiki should help in studying the participation of different researchers and research groups in the activities of IMIA, and the "social networks" of scientists, practitioners, and education specialists that have led the activities of the organization, supplementing conventional citation analyses. The patterns of participation and interaction between different regional and world-wide activities of IMIA will be clearly outlined and visualizable on maps and correlated to summaries of the subfields of specialization of medical informatics, and the main themes that have dominated the discourse and publications in our discipline will also be more clearly analyzable. This represents a novel informatics-based community-building enterprise, very much like Wikipedia content development, but focused on the specific discipline of biomedical and health informatics, and for its specific worldwide association: IMIA (figure 2).

3. PANEL ORGANIZERS AND PARTICIPANTS

- George I Mihalas - president of EFMI 2006-2008, member of IMIA History Task Force, University of Medicine and Pharmacy, Timisoara, Romania.
- Jana Zvarova - director of the EuroMISE Center since 1994, Czech Republic representative in EFMI and IMIA, First Faculty of Medicine of Charles University in Prague and Institute of Computer Science of the Academy of Sciences of the Czech Republic.
- Casimir Kulikowski - member of IMIA Board, chair of IMIA History Task Force, Rutgers University, New Jersey, USA.
- Marion Ball - president of IMIA 1992-1995, senior advisor IBM Research, John Hopkins University, Baltimore, Maryland, USA.
- Jan H van Bemmel - president of IMIA 1998-2001, former rector of Erasmus University Rotterdam, The Netherlands.
- Arie Hasman - vicepresident of IMIA 2010-2013, chair Education WG of EFMI, University of Amsterdam, The Netherlands.
- Izet Masic - Bosnia-Herzegovina representative in EFMI, chair of MIE 2009, President of Academy of Medical Sciences of Bosnia and Herzegovina, Chair of Task Force of EFMI Medical informatics journals.
- Barry Barber - member of EFMI founding group, UK representative in EFMI 1976-1999, honorary member of EFMI.
- Diane Whitehouse - The Castlegate Consultancy UK, previously worked in the e-Health and e-Inclusion units, European Commission, Brussels, co-editor of "e-Health Management: From Vision to Reality" (in press).

Power Point Presentations and other deatails about the Panel can be found at http://stc2013.org/joint-activities/panels

CONFLICT OF INTEREST: NONE DECLARED.

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