

E-Health Resources in the Graduate and Postgraduate Medical Education in Hungary

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Abstract

Although biomedical informatics lacks a clear and theoretically-grounded definition, there is a general consensus on its involvement in the training of health professionals. Since medical education is fully packed with traditional disciplines (anatomy, physiology, surgery, etc.) and also with new, challenging subjects like molecular biology or genetics, it is very difficult to find an appropriate slice of time in the curriculum for the proper training of medical informatics. Although there are accepted recommendations by professional organizations (e.g.: International Medical Informatics Association [IMIA]) on what makes up an informatics curriculum, medical schools teach what they consider important, what can be financed and what can be fit into the tight time frame. In this paper, we describe the most important factors influencing medical informatics education in general, in Hungary and at our faculty in particular.

Our department is responsible for teaching medical informatics for students in medicine, dentistry, pharmacy and nursing. In addition, we provide courses for post-graduate students in various PhD programs focusing on specific aspects of info-communication involved in all phases of research. We summarize our teaching experience over the past ten years and explain how we teach biomedical informatics to different groups of health professionals. We call attention to the need for defined basic skills and knowledge in informatics at each level of the health care education. We emphasize that even with limited resources, it is possible to create and maintain valuable training programs especially with effective trans-border cooperation.

Keywords

medical curriculum, biomedical informatics, e-health, graduate and post-graduate studies, trans-border cooperation

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1 Introduction

Although there are obvious variations among specialties, physicians spend 25-30% of their time on administrative tasks that require the use of computers and other information technology devices. Nowadays, with universal accessibility, internet databases are considered a major avenue in making medical knowledge available to almost all medical professionals. The booming field of medical informatics and e-Health assists physicians and healthcare specialists in diagnosis, follow-up, and treatment of patients through electronic means over wide geographic

distances. The use of e-Health approaches and systems in the healthcare sector is becoming a daily practice, as almost all medical practitioners increasingly use computers to store patients' data, assist the patient, and make decisions via support systems and databases, etc. Accurate diagnosis, better treatment solutions and patient relationships are increasingly within reach when using e-Health facilities. It has been accepted widely that the use of medical informatics creates a hub for medical database management, and contributes greatly to the evolution of diagnostic and treatment technologies. As a result, a lot may be expected of medical informatics with respect to

promoting improvement of health conditions throughout the world, both by contributing to the quality and efficacy of health care, and accomplishing research in the fields of innovative biomedical as well as computer, health, and information sciences.

In 2003, the Institute of Medicine's Health Professions Education Summit identified the utilization of informatics as one of the five domains of core competency for health care professionals [1]. Additionally, informatics also underpins the other four competency domains, which are to provide patient centered care, to work in interdisciplinary teams, to employ evidence-based practice, and to apply quality improvement [1].

It is also important to point out that, in a draft level survey of The Tuning Project for Medicine [2] the Use of information and information technology effectively in a medical context was ranked 10 among the 12 highest Competences/Learning Outcomes (N.B. preceding Apply scientific principles, method and knowledge to medical practice and research). In view of the statements above, it is essential to address

- the current situation of medical informatics training in Hungary,
- its conformity with international standards, recommendations and trends and
- the potential of establishing cross-border cooperations in the development of advanced curricula in the training of medical and other health science professionals.

According to E-Health indicators, nearly all Hungarian doctors use a computer at their offices; however, permanent internet access and the use of professional web sites are still limited and personal web presentation is below the European average.

Although medical professionals and institutions emphasize the need of the continuing medical education (CME) for maintaining and improving knowledge, skills, competence and performance, unlike in several countries [3], there is no existing national CME program that covers certain specific fields such as medical informatics. With the overall growth of informatics, the medical education system should also provide programs at both graduate and post-graduate levels. While there is a wide consensus as to the importance of this urgent need, several factors hamper the construction and operation of a CME system in medical informatics. In particular:

1. lack of involvement of health informatics in the core curriculum of most medical schools,
2. limited human and instrumental resources of educational institutions, including medical and nursing schools,
3. competence and skill level are not well defined and measured,

4. there are no comprehensive education programs currently available.

2 Methods and Results

We have collected relevant information from the 4 Hungarian faculties of medicine (Budapest, Debrecen, Pécs and Szeged), from the most active partner universities in Romania (Timisoara and Cluj) and the University of Vienna, Austria. We have been teaching medical informatics for more than 15 years and collected information from colleagues, former and present students, etc. We have made a critical review of the contents of the courses taught.

The four Hungarian medical schools have differing educational strategies and programs for medical informatics.

When we compare the formal description of curricula, we can conclude that in most faculties the medical informatics is taught early on in the medical studies. In Hungary, medical studies are divided into 4 parts (semesters 1-4: basis sciences, semesters 5-6: pre-clinical studies, semesters 7-10: clinical studies and semesters 11-12: clinical rotation). As Table 1 indicates, medical informatics is taught explicitly in 3 of the 4 schools. In all places informatics-related subjects are elective (in the table "C" can be misleading because it indicates that the subject is still elective but "strongly recommended"). In other words, 80% of the Hungarian medical students would currently be able to fulfill the curricular criteria without taking a course in medical (or any) informatics. In fact, it has been indicated that 50-80% of the students attending the medical schools do take courses in informatics. The inhomogeneous course structure summarized in Table 1 also indicates that while there is a tendency to create an independent course for medical/bioinformatics it is far from general. Additionally, although biostatistics (elementary statistics) is a mandatory subject in the curriculum, in most medical faculties, biostatistics has not been separated from medical informatics.

Effective use of medical information systems requires harmonized educational programs in medicine, nursing, health care management, dentistry, pharmacy, public health, health record administration, and informatics/computer science. Because of the diverse structure of the graduate and postgraduate education, it is almost impossible to establish dedicated complementary programs [4, 5]. At the University of Szeged, our department is responsible for the teaching of medical informatics for students in medicine, dentistry, pharmacy and nursing. It has always been a complex task to create profession-specific education programs that are also cohesive with one another [6, 7]. There is an agreement that all curricula should include some common components (basic concepts and common software available for higher education in Hungary) but there is an ongoing debate on what kind of additional specific tools and resources should be involved.

Table 1: Components of medical informatics curricula at Hungarian universities (C: Compulsory Subjects; C/E: Compulsory Elective Subjects; E: Elective Subjects; O: Optional).

Faculty of Medicine	Course	Semester	Credit	Hrs/week (Theory)	Hrs/week (Practice)	C; C/E; O
Debrecen	Medical Informatics	1-2	3	0	2	C/E
	Biostatistics	1	2	1	1	C
Budapest	Biostatistics and Informatics	1	3	1.5	2	C
	Biostatistics II.	7-10	2	1	1	C/E
	Medical Informatics	7-10	1	1	0	C/E
Szeged	Informatics	2	3	1	2	C/E
	Biostatistics	1	1+2	1	2	C C/E
	Medical Informatics I. II.	8-10	2/2	1/1	1/1	C/E
	Biostatistics II. III.	8-10	2/2	1/1	1/1	C/E
Pécs	Biostatistics	1	2	1	1	C
	Informatics: I.-II.-III.	8-10	1/1/2	0.5/0.5/1	0.5/0.5/1	C/E O
	Informatics of Medical Literature	8-10	2	0	2	O

Our approach is very practical: with close cooperation with faculty members of the schools of dentistry, pharmacy and nursing, and via the specialization of our teaching staff we try to define the profession-specific targets. Specifically, nurses have commonly been regarded to possess poor IT skills (and are not motivated for the introduction of IT); it has also been observed that nurses are more frequently reluctant to use computers than other health-care staff groups, and have made more statements against curriculum development in all disciplines. We must make it clear for them that computers will not disappear from health care; on the contrary, their increasing use is unequivocally predicted. Changing the attitude of nurses is a particular challenge for our department.

A further question is the phase of medical training in which medical informatics should be introduced [8]. At the Faculty of Medicine of the University of Szeged, medical informatics is taught in the second semester of the first academic year, as an elective subject. Currently, about 85-90% of the students choose this course. The lectures (1 hr/week for 14-15 weeks) cover the basic concepts of informatics, its development, the fundamentals of computer architecture, principles and functions of operating systems and computer networks. Special emphasis is given to the creation of electronic documents, the characteristics of textual, tabular, graphic and other components of documents and their unification. The lectures deal with the possibilities inherent in the Internet, the properties of databases and data warehouses, and the most significant medical, biological and bibliographic databases available. The aim of the practical course (2hr/week in small groups -less than 16 students in each) is to provide the students with a basic practical knowledge in electronic communication and evaluation of biomedical data, and with the tools and knowledge to create electronic documents.

Even if medical informatics modules obtain some limited niche, they must be adapted to the rigid, weekly-

based, formal and traditional lecture-practice structures. Innovations such as intensive, course block structures, in which students learn about problem-driven medical informatics as a component of diagnosis are very rare. Such structural changes in the educational system disturb the traditional composition of a semester and may generate undesired, contradicting opinions and tension among professors of other disciplines. Additionally, even with the implementation of programs proposed above, very limited skills can be taught within a short period of a week or so. It is important to recognize medical informatics as a tool and a skill. Any skill is learned and imprinted most efficiently when the education is problem-driven and put into the context of the environment it is to be used within.

For these reasons, we have to be aware of the demands of other departments and the specific electronic teaching material they offer when we assemble the material of our medical informatics course. Developing a wide knowledge about the nature of medical information and how it may be obtained from the internet also prompts the departments of medical informatics to develop their general curriculum accordingly. For students who are interested in extra-curricular research activity there are elective courses in the 4th-5th years dealing with specific problems such as biomedical signal acquisition and processing, or advanced statistics. The use of statistical packages assumes a basic knowledge in calculus and applied statistics but the proper use also requires advanced knowledge in informatics. In order to correspond with the more practical period of medical training, some studies suggest that medical informatics courses should be integrated into the later, more hands on, portion of the education (7th-10th semester) [8]. On one hand it is a good idea to have training later on in the program because the technology discipline changes very quickly and skills learned in the 1st year may not still be current in the sixth year, on the other hand informatics knowledge could improve the basic medical studies from the very beginning. Therefore we made

a compromise, there is a course in the second semester and there is additional make-up or advanced courses offered later on the studies.

Even with advanced human, methodological and technical background we have to face to several problems and answer important questions.

What are the major motivations that could attract medical students to take up medical informatics as an elective subject? How can these students transform informatics knowledge and computer skills gained during the module into skills that aid in learning fundamental medical subjects such as anatomy, physiology, surgery or general medicine more effectively?

As our department teaches medical physics and statistics, we have the unique opportunity to communicate with students from the very beginning of their university careers to point out the usefulness of informatics. Our teaching material is available on internet (www3.dmi.u-szeged.hu); records of laboratory practices are documented on intelligent platform, and the calculations in statistics seminars are also computer-based. Therefore we can convince the students that they would benefit a lot by choosing “medical informatics” as an elective course.

Mandatory courses in informatics and statistics are an essential part of postgraduate university education programs in Hungary. At our faculty, informatics and statistics are taught in two semesters (30 and 45 hrs, respectively). In contrast to undergraduate courses that concentrate on basic skills and everyday medical practice, PhD courses focus on specific aspects of info-communication involved in all phases of research: the efficient use of scientific databases, data organization, processing and presentation. An important feature of these courses is that medical PhD programs involve a substantial number of non-MD participants, such as biologists, pharmacists, chemists, physicists, etc.; this necessarily broadens the scope of the training.

Apart from the proper establishment of a medical informatics module, it would be very useful for medical students if they are provided with a detailed picture on the specific information infrastructure available at their medical school (mailing system, security, e-library, administrative supports like patient registration, etc.), upon their admission. This introduction might also increase the familiarity of medical students with information technology and electronic facilities at the medical school. At the same time, this may not necessarily be the task of the medical informatics departments exclusively, but could preferably be a joint effort among various departments.

3 Discussion

3.1 Human Resources

With the advent of computing science, computational resources gradually became available in the environment of university medical faculties, teaching hospitals, etc.

University computing centres, running mainframes and providing computational service in the 1970's and 1980's, were particularly helpful for clinical and medical research teams that needed help in various areas, such as signal processing, data organisation and analysis, database building and mathematical modelling; as well, the staff of these Hungarian university computer centres were often involved in graduate and postgraduate teaching at the university. This symbiotic and interactive environment for the developers and the users of the medical informatics systems was very fertile in formulating new concepts and procedures, and it more than offset the limitations inherent in the computing facilities of that decades. During the last twenty years many parts of the former system became independent from the universities. Software development, network maintenance and other special tasks were formed into their own spin-off companies that offer services to medical schools. Therefore, research and development became independent and was no longer deeply embedded into the university environment. Today, we unfortunately experience a gradually increasing distance and a phase lag between the information created by the industrial solution providers and what is available to medical teams seeking solutions for their specific informatics problems in medical research, practice and education. In addition, if research is not done within the academic environment there are no financial resources to cover the costs of conferences and workshops to increase learning and knowledge. Co-operation of all the parties involved in the phases of the problem identification, idea formulation, development of tools and their testing is badly needed.

The increasing need for better and more comprehensive training in informatics is strongly limited by several factors including teachers. The most crucial point is how to recruit and maintain staff for teaching medical (health) informatics. Since there is a general shortage of well-trained experts, medical schools have to compete for teachers with informatics companies, which offer far higher salaries and better career opportunities. Consequently, it is almost impossible to offer such income or/and promotion opportunities that would attract young professionals to join informatics departments.

Medical informatics should not be solely the subject of specific courses or specific departments. It should be a general approach throughout an entire training program. Therefore, it seems desirable that education professionals undergo special training to learn new teaching methods and utilization of educational aids including information technology, newer media, interactive learning, group education and individualized teaching. There are obvious questions to be answered: who trains the trainers, who sponsors such trainings and how could it fit into the program of a faculty? Since countries like Hungary have a small number of teachers on the field of biomedical-health informatics we welcome the initiative by the IMIA of establishing international exchange programs for students and teachers [9].

3.2 Structural Barriers

There are many reasons why medical schools are reluctant to incorporate medical informatics in their core curriculum. First of all, medical school professors do not all fully recognize the importance and meaning of medical informatics. Secondly, the densely packed medical school curriculum does not leave a suitable time slice for the proper training of medical informatics [10].

Lack of involvement of health informatics in core curriculum in most medical schools creates artificial barriers in medical education and slows down information transfer. The lack of formal health informatics training begs the questions as to whether future doctors will understand the full capabilities of electronic platforms and technologies, and whether they will know how to evaluate them and integrate them into their practices.

A recent paper by Stead et al. [11] discusses the major directions and tasks needed for better e-Health education. The authors emphasize that medical schools should have academic units in biomedical informatics in order to achieve a sufficient knowledge for education and research. Only this can ensure that clinical information systems are fully integrated with and support the education and research missions of the medical school. In addition, medical educators should also be sufficiently trained to model clinical and research IT applications, in order to modernize curricula appropriately, and evaluate trainees and teaching methods [3].

3.3 Standards and Development

The question asked many years ago, "To what degree are medical schools teaching medical informatics and how?" has still only partially been answered. Medical Informatics is a constantly developing field. Some years ago, topics like literature searching, internet use, computer assisted diagnosis, hospital information systems and electronic patient records constituted the maximum requirement for a medical graduate. Today telemedicine, telediagnosis, and patient-support systems also require more and more attention in a curriculum.

Although there are very good standards (they should be updated year by year) on what makes up an informatics curriculum [9], medical schools teach what they consider important, what can be financed and what can be forced into the tight time-frame [8].

Despite the European legislative framework requiring mutual recognition of medical degrees and qualifications, little has been done to examine the comparability and standards of such qualifications or to describe them in detail. Responsibility for deciding what should be learned during that time and what the outcomes of that learning should be is devolved to individual medical schools.

The challenges faced by medicine today are enormous. Setting and continuously updating curricula are an ongo-

ing task of all medical schools [6, 9, 12]. Our experience indicates that recommendations by the IMIA are extremely useful in curriculum development but these recommendations usually do not reach the appropriate persons with decision competences. Medicine has always welcomed new technology; therefore informatics was incorporated into everyday medical practice decades ago. In fact, the development of many fields in informatics was driven by the demands of health care and occasionally stimulated by the medical educational system.

3.4 The System Should be Output Driven

Although it is desirable for all kinds of medical professionals to graduate with a certain set of computer and information management skills, there are no general computer skill assessment systems which allow national or international comparisons and evaluation of such skill-sets. It is imperative to define the basic skills and knowledge requirements for various health care professionals [5]. It would be a challenging, but worthwhile, project to construct an international evaluation system which would be accepted by the various faculties teaching health sciences. Development of an ongoing training program for employees including the educational staff is a task closely related to the graduate and postgraduate courses organized for students.

The lack of formal health informatics training begs the questions as to whether future doctors will understand the full capabilities of electronic platforms and technologies, and whether they will know to evaluate and integrate them into their practices. Several studies indicate that, although to differing degrees, training problems in E-Health affect almost all countries [3, 9, 10, 13, 14]. Establishing informal and formal professional networks would help in constructing and updating curricula, and setting acceptable competence and skill levels. Therefore, there is an urgent need for harmonized national and international programs for better education of the health professionals.

3.5 Cross-Border Projects May Help in Finding Additional Resources

Common cross-border projects combining the efforts on specific issues should aim at finding salary supplements and facilitating common research-development activity. When we consider effective cross-border collaborations in education programs of our discipline, it is worth mentioning that the terms medical informatics and biomedical informatics have diverse definitions in distinct geographical regions and even within the same country [12]. Therefore intensive discussions and careful exploration of the various definitions/descriptions in the neighbouring areas would help in reaching consensus and in finding common terminology [7]. The artificial political, cultural and economical separation during the second half of the previous century also has forced Hungary to find individual

solutions for problems in medical informatics training, as well as all other fields of health care [14]. When globalization incorporated our countries into Western culture, countries of the former Eastern block had no choice but to follow international trends, by taking on widely accepted operation systems, adapting basic documentation methods and implementing Western-type education systems. Even though adaptation became a universal routine, the presence of various backgrounds and former goals resulted in information systems in the former socialist countries becoming disparate and confusing [13]. Now, the necessity of more intensive regional dialogues and cooperation urges experts in biomedical informatics to engage in more intensive collaboration, in order to establish joint concepts and practice for improving the health conditions of our countries [9, 15, 16]. Consequently, we have to voice our individual problems, and analyze them in order to find common solutions. It has been emphasized several times that human resources are critical in determining the level of performance of the health care delivery and for the attainment of national health goals in all countries.

4 Conclusions

In summary, an efficient development of partnerships within the health care system assumes that all professionals involved must possess strong informatics and interpersonal knowledge, and skills reaching beyond their own individual fields. There is an emerging need to define the basic skills and knowledge for each level of the health care education. A wide range of collaboration including trans-border cooperation offers a unique opportunity for the establishment of common criteria for basic skills and knowledge, via joint discussions, collaborative thinking and concerted action.

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