Spreading Knowledge in Medical Informatics: the Contribution of the Hospital Italiano de Buenos Aires

F. Gonzalez Bernaldo de Quiros, D. Luna, P. Otero, A. Baum, D. Borbolla
Department of Health Informatics, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

Summary

Medical Informatics (MI) is an emerging discipline with a high need of trained and skillful professionals.

Objective: To describe the educational experience of the Department of Health Informatics of the Hospital Italiano de Buenos Aires.

Methods: A descriptive study of the development of the Medical Informatics Residency Program (MIRP) and the e-learning courses related to medical informatics.

Results: A four-year MIRP with 15 rotations was started in 2000, and was awarded national educational accreditation. Eight residents have been fully trained and their main academic contributions are shown in this study.

The e-learning courses related to medical informatics (Healthcare Management, Epidemiology & Biostatistics, Information Retrieval, Computer Literacy started, 10x10 Spanish version and HL7 introductory course) started in 2006 and were followed by more than 2266 students from all over the world, with an increase trend in foreign students.

Conclusions: These educational activities have produced skilled human resources for the development and maintenance of the health informatics projects at our Hospital. In parallel, the number of students trained by e-learning continues to increase, demonstrating the worldwide need of knowledge in this field.

Keywords

Biomedical informatics, education, health information systems, healthcare workforce

Introduction

Medical Informatics (MI) is an emerging discipline that has been growing for the last 20 years [1]. It has been defined as the field concerned with the management and use of information in health and biomedicine [2]. It is generally acknowledged that MI is a discipline that requires trained and skilled professionals [2, 3] since it is not only related with computers and technology, but also with how information is obtained and used in its context [4].

One well-known initiative that addresses the need for training in MI is the 10x10 program launched in 2005 by the American Medical Informatics Association (AMIA) and the Department of Health Informatics & Clinical Epidemiology of Oregon Health & Science University (OHSU). Having a similar aim in mind, the Hospital Italiano de Buenos Aires (HIBA), a non-profit healthcare academic center founded in 1853, started a graduate and postgraduate education program in 2001, with the goal of achieving great impact in the Latin American region (22).

The educational offer of HIBA includes 30+ medical residency-training programs, 34 fellowship programs, a School of Medicine, and a School of Nursing. The MI residency is one of the most recent medical residency programs, having been created in 2000. Since 2006, HIBA also uses an e-learning platform aiming to teach professionals who are interested in MI and other medical issues, all over the world.

The objective of the present study is to describe the incremental contribution of the Hospital Italiano de Buenos Aires to the educational need in this field.

Methods

Study design: A description of the residency program and virtual courses at HIBA between 2006 and 2008.

Setting

HIBA has a network of 2 hospitals amounting to 750 beds (200 for intensive care) 500 home-care patients under care, and 23 clinics. Its insurance plan covers approximately 150,000 people and it also coordinates insurance for another 1,500,000 people who are covered by affiliated insurers. Each year over 36,000 inpatients (pediatric and adult) are admitted to our hospitals, which are located in the city of Buenos Aires and suburban area. More than 2,400,000 outpatient visits from patients from all over the country and Latin America are received in the HIBA.

In 1998 HIBA decided to implement a Healthcare Information System (HIS) called "ITALICA". It is an in-house project that currently handles all the information related to healthcare both clinical and administrative from its capture to its analysis. As part of the project, the Department of Health Informatics was created in 2001 involving 120 people including clinicians, IT pro-

fessionals and technicians. (Figure 1). The e-learning management system is Moodle (Modular-Object-Oriented-Dynamic-Learning-Module-Environment), a free, open-source package designed to help educators create effective online learning communities [5].

Results

A - Residency Program in Medical Informatics

The four-year Medical Informatics Residency program was created in 2000 in order to train human resources in this field. Currently it is the only program of its kind in Argentina and was recently approved by the National Commission for Universities Evaluation – CONEAU as a postgraduate medical specialty degree course.

The main objective of the program is to train physicians to be liaisons between the healthcare and the information technology in the life cycle of health information systems. A multidisciplinary team is engaged in the program including IT specialists, clinicians (physicians and nurses), statisticians, epidemiologists, healthcare managers and anthropologists or social science experts.
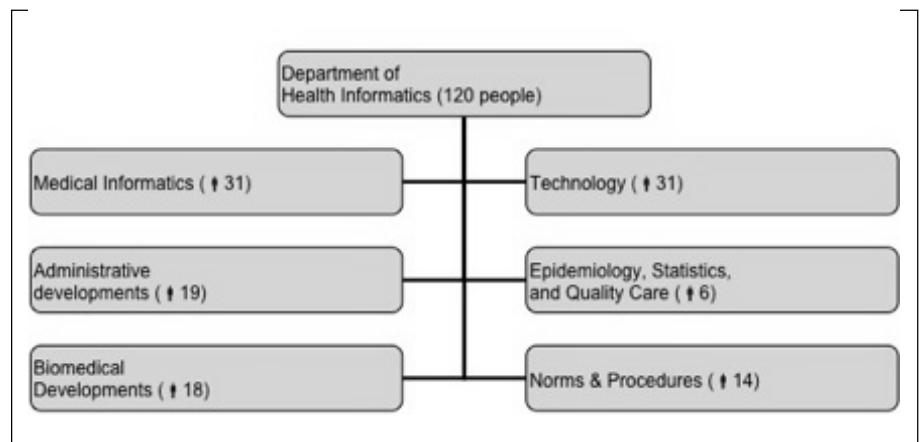

Fig. 1 Organization of the Department of Health Informatics at Hospital Italiano de Buenos Aires

The program offers 15 rotations with both theoretical and practical aspects that allow residents to participate in the analysis, design, development, implementation and evaluation of the ITALICA project. The objectives and duration of the rotations of the residency as well as their main academic contributions are shown in Table1.

Since 2001 eight residents have been trained (mean age of 26 years, 25% female).

Residents are involved in the development and maintenance of the hospital's information system (ITALICA), which handles non-clinical information from local master files and clinical information that includes diagnosis, medical tests, drugs and medical devices, is stored in a clinical terminology server that facilitates semantic interoperability [6]. The residents work consists of a local interface terminology (thesaurus) mapped to a reference vocabulary, SNOMED CT [7]. The thesaurus is a list of terms created from almost 2 million free text inputs extracted from the clinical data repository. The local interface terminology allows users to record clinical data choosing options

Table 1 Objectives, duration in months and main academic contributions of the MI residency rotations at the HIBA

Rotation (duration in month)	Main objectives / skills	Peer-reviewed publications
Introduction to Biomedical Informatics (3)	- 10x10 program	Otero P, Hersh W, Luna D, Lopez Osornio A, González Bernaldo de Quirós F. Translating implementation and evaluation of a medical informatics distance learning course for Latin America. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P421
Health Information Systems (2)	- EMR design and implementation	Osornio AL, Marti SG, Gambarte L, Staccia G, Schpillberg M, Soriano E, Otero P, Luna D, Gonzalez Bernaldo de Quiros F. Creation of a web-based icpc encoder and a secondary codification variability. Developing tools from a free text variability analysis of diagnostic descriptions records. Medinfo. 2004; 2004(CD): 1789.
		Borbolla D, Giunta D, Figar S, Soriano M, Dawidowski A, González Bernaldo de Quiros F. Effectiveness of a chronic disease surveillance systems for blood pressure monitoring. Stud Health Technol Inform. 2007; v. 129, p 223-7. PMID: 17911711
		Montenegro S, Rubinstein F, Kopitowski K, Michelangelo H, Lopez Osornio A, Luna D, Soriano E, González Bernaldo de Quirós F. Development and implementation of Physician Profiling Tool. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P478
Interoperability and security (3)	- Master file (development and maintainance) - HL7	

Management of biomedical knowledge (3)	- Terminology Server (development and maintainance) - Information Retrieval	Reynoso, G; March, A; Berra, C; Strobietto, R; Barani, M; Iubatti, M; Chiaradio; M P; Serebrisky, D; Kahn, A; Vaccarezza, O; Leguiza, J; Ceitlin, M; Luna, D; González Bernaldo de Quirós, F; Otegui, M I; Puga, M C; Vallejos, M. Development of the Spanish Versión of the Systematized Nomenclature of Medicine: Methodology and Main Issues. Publicado en los Proceedings del Simposio Anual de la American Medical Informatics Association. Noviembre del 2000. PMID: 11079973
		Otero P, Pedernera F, Montenegro S, Borbolla D, Garcia Marti S, Luna D, Gonzalez Bernaldo de Quiros F. Evolution of medical informatics in bibliographic databases Stud Health Technol Inform. 2004;107 (Pt 1):301-5. PMID: 15360823
		Gambarte ML, Lopez Osornio A, Martinez M, Reynoso G, Luna D, González Bernaldo de Quiros F. A practical approach to advanced terminology services in health information systems Stud Health Technol Inform - 2007, v.129, p.621-5 PMID: 17911791
		Lopez Osornio A, Luna D, Gambarte ML, Gomez A, Reynoso G, González Bernaldo de Quiros F. Creation of a Local Interface Terminology to SNOMED CT. Stud Health Technol Inform - 2007, v.129, p.765-9 PMID: 17911820
		Campbell J, Lopez Osornio A, González Bernaldo de Quirós F, Luna D, Reynoso G. Semantic interoperability and Snomed CT: A Case Study in clinical problem lists. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P387
Change management in medical informatics (4)	- Information needs - Psicosocial and Organizational aspects - Usability concepts	Luna D, Osornio AL, Marti SG, Lopez G,Ciffarelli G, Otero P, Gonzalez Bernaldo de Quiros F, Soriano E, Durante E. Patients and Physicians have different opinions about the use of a Computer Patient Record System in ambulatory setting. Medinfo. 2004; 2004(CD):1731.
		Dawidowski A, Toselli L, Luna D, Oberti P, Soto M, González Bernaldo de Quirós F. [Changes in physicians' attitudes to computerized ambulatory medical record systems: a longitudinal qualitative study] Gac Sanit - 2007, v.21, p.384-9 PMID: 17916302
		Baum A, Mauro A, Luna D, González Bernaldo de Quirós F. Evaluating designs against users requirements in Latin America: an experience of human-centred methods, techniques and tools on a low budget. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P416
Applied clinical informatics (4)	- Clinical Decision Support Systems	Luna D, Otero V, Canosa D, Montenegro S, Otero P, de Quirós FG. Analysis and redesign of a knowledge database for a drug-drug interactions alert system. Studies in health technology and informatics - 2007, v.129, p.5 PMID: 17911843
Health Informatics Subspecialities (3)	- Telemedicine - Nursing Informatics	Pedernera F, Luna D, Plazzotta F, Gassino F, Martinez M, González Bernaldo de Quirós F. Remote follow-up of liver transplant patients: a telemedicina implementation Project in Latin America. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P432
Multimedia in health informatics (2)	- RIS/ PACS	Sosa G, Navas H, Cancio A, Plazzotta F, Otero P, Luna D, González Bernaldo de Quirós F. Integration of specialist and ancillary services system into a HIS: Development and implementation of a generic report system. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P251
		González Bernaldo de Quirós F, Plazzotta F, Gomez A, Luna D. Interoperability and Security: Design and development of a Clinical Document Repository Digitally Signed using CDA Standard. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P390
Evaluation in Medical Informatics (2)		Navas H, Lopez Osornio A, Baum A, Gomez A, Luna D, González Bernaldo de Quiros F. Creation and evaluation of a terminology server for the interactive coding of discharge summaries. Stud Health Technol Inform - 2007, v.129, p.650-4 PMID: 17911797
		Mauro A, Baum A, Galarza C, Otero P, Luna D, González Bernaldo de Quirós F. Value Added: needs, motivations, hopes and fears of Argentine patients about the development of their personal health records. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P007
		Dawidowski A, Baum A, Mauro A, Schachner V, de los Rios E, Luna D, González Bernaldo de Quirós F. An ethnographic focus for the study of information needs in the emergency center of the Hospital Italiano de Buenos Aires. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P334
Project Management (2)		Baum A, Figar S, Serverino J, Assale D, Schachner B, Otero P, Luna D,Gonzalez Bernaldo de Quiros F. Assessing the Impact of Change in the Organization of a Technical Support System for a Health Information Systems. Stud Health Technol Inform. 2004;107(Pt 2):1367-70. PMID: 15361038
Mapping process (2)		Plazzotta F, Benitez S, Fabini D, Schachner B, Mogni V, Luna D, González Bernaldo de Quirós F. Shortage of beds: A local solution for a global concern. A traffic light system. 12th World Congress on Health Informatics. Brisbane, Australia. 20-24 August 2007. (CD) P262
Computer Literacy (6)		Galarza, Carlos R; Cuffaro, Paula E; Luna, Daniel; Gómez, Adrián; Reynoso, Ariel; Langlois, Esteban; Musri, Carlos; Marchetti, Marcelo; González Bernaldo de Quirós, Fernán. - Calidad de comunicación para una mejor salud. Oportunidad y desafío de la World Wide Web / Quality of communication for a better health. Opportunity and challenge of the World Wide Web. Nexo rev. Hosp. Ital. B.Aires; 23(2):8-13, jun. 2003.ilus. ID 391885
Health Management (24)		Figar S, Waisman G, González Bernaldo de Quirós F, Galarza C, Marchetti M, Rodríguez Loria G, Camera L, Seinhart D, Camera M. Narrowing the Gap in Hipertensión: Effectiveness of a Complex Antihypertensive Program in the Elderly. Disease Management, Volume 7, Number 3, 2004. PMID: 15669583
Epidemiology	- Software development for the surveillance of chronic diseases	Software for Follow-Up and Control of a Patient Population With Chronic Diseases. Technol Health Care. 2004 December 2004;12(5):369.

from a list of familiar terms but storing information coded with SNOMED CT [8]. The system also provides users with the equivalence of a given local term in standard classifications such as ICD-9CM, ICD-10 or ICPC2, and includes a model for dynamic subset definitions, which are a set of rules that allow the definition of a subset in terms of their relationships with SNOMED CT concepts [9-11].

Residents also work on the development and implementation of the EHR, which is patient-centered and problem-oriented and is currently working in outpatient, inpatient, emergency care and home care settings with different modalities of implementation. A Picture Archive and Communication Systems (PACS) and a Signal Archive and Communication System (SACS) were recently implemented and provide full interoperability between images and the EHR, thus enabling the images and signals to be seen directly from the EHR application [12].
A Chronic Disease Management System (CDMS) that uses clinical information from the EHR has also been implemented [13, 14]. It was awarded the "Best International Disease Management Program" prize, at the 5th Annual DMAA (Disease Management Association of America) Conference in 2003, Chicago, USA.

A Personal Health Record has been created that helps patients participate more actively and interact with different areas of the HIS]. A project for the implementation of a clinical decision support system called "Sebastian", developed at Duke University, is also being tested [16].

B - E-learning Courses Related to Medical Informatics

The first e-learning course was launched in 2006 focused on computer literacy and information retrieval. Figure 2 shows the temporal linear trend in the annual number of students. Most of the students were from Argentina and

from other Spanish-speaking countries. A world map with the total number of students that attended the e-learning courses is shown in Figure 3.

Description of the e-Courses

Introduction to Biomedical Informatics (in collaboration with AMIA's 10x10 training program)
The initial work consisted of the adaptation of the different modules offered by OHSU to Latin American needs. The course provides general knowledge on biomedical informatics focusing on clinical care and public health by covering topics such as: electronic health records, terminology and standards, healthcare quality and patient safety. The main goal is to provide students with tools to develop or take part in a team that provides solutions to healthcare problems with the help of IT. By the end of the course, the students are expected to be able to implement health informatics projects in their institutions.

The course was launched in March 2006 and, after 4 revisions, contains 11 current modules designed to be delivered in twelve one-week units, requiring about ten hours of work per week, through the Virtual Campus of HIBA.
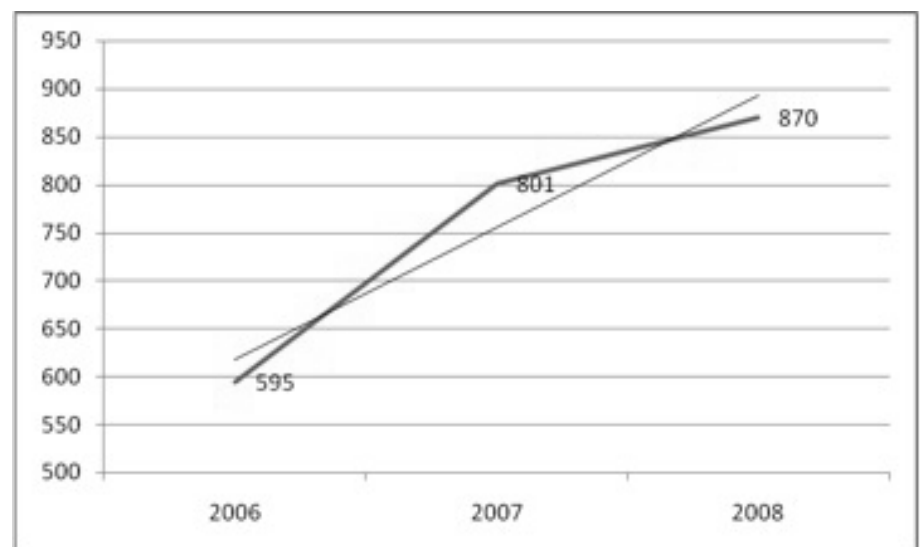

Fig. 2 Annual number of students of e-learning courses delivered by the Hospital Italiano de Buenos Aires

Fig. 3 Number of students by country of e-learning courses on health informatics delivered by the Hospital Italiano de Buenos Aires

The teaching modalities used for the course include lectures, threaded discussion boards, recommended readings, and self-assessment. The final evaluation of the student consists of a written test where students have to answer three multi-part questions. All students who pass the evaluation obtain a certificate of completion issued by AMIA and the School of Medicine of HIBA.

At the end of the course, the students are surveyed about the course characteristics, the interaction with their teachers, the e- learning modality and the main features of the course using a Likert scale (1 worst to 5 best). The overall average score obtained was 4.3/5.

The course is supported by an 850-page handbook made from the content of all the modules, and is used as bibliographic material in Spanish, in order to help people to learn in their own language, since most of the learning material, books and journals available from the specialty are mostly available in English.

Computer Literacy Course

This course aims at training healthcare professionals in the use of office automation applications, with a focus on Microsoft's Windows operating system, on the structure and functioning of the Internet, and especially on learning how to use a word processor, a spreadsheet, a database management system, and a multimedia presentation authoring tool. We believe that there is a lack of this type of training, especially in healthcare professionals. We used the competencies catalogue proposed by the International Computer Driving License (ICDL).

Information Retrieval Course

This online course teaches the most important subject-specific scholarly information sources and basic skills for systematic information retrieval. Students are trained to understand how information is stored and organized in bibliographic databases, to acknowledge different information needs, to turn them into an answerable question,

to learn how to use bibliographic databases such as MEDLINE, to complement with the use of other web resources, and to create personal bibliographic databases using a software tool for publishing and managing them.

Introduction to HL7 Course

The Department of Health Informatics at HIBA has collaborated with HL7 Argentina and HL7 International for the development of this course, which aims to introduce the key concepts of electronic messaging interoperability in health care. The course was initially developed in Spanish and later was translated into and adapted for the English language. Students are introduced to the key concepts in electronic messaging standards and communication focusing on the implementation of the HL7 messaging system, to understand and apply the Reference Information Model (RIM) in instances of data exchange and to apply a reference model for the exchange of clinical document. The course lasts 10 weeks and uses the Virtual Campus of HL7 Argentina; the students have weekly assignments with "hands-on" exercises on real interoperability problems.

Health Care Management Course

This 2-year course aims at improving the management capacity of professionals who will be CEO or CIO in healthcare institutions in Argentina by providing an introduction to healthcare management. The program contains the following modules: Management of healthcare systems, Healthcare information systems and introduction to medical informatics, Epidemiology applied to healthcare systems, Healthcare economics, Healthcare quality and circuits of continuous improvement and Management of Chronic diseases.

Epidemiology and Biostatistics Course

This course for healthcare professionals teaches the basic concepts of epidemiology, the different study designs and the basics of descriptive and inferential statistics.

Discussion

The recommendations given by the International Medical Informatics Association on education in health and medical informatics are oriented to fulfill the training needs for the acquisition of knowledge and skills in information processing and information technology applied to healthcare. They also establish the importance to train human resources in this discipline, so that they can organize, coordinate and develop health informatics projects in healthcare facilities. These recommendations address the different topics or modules that need to be taught according to the level of education or type of work related to the field. Other authors have stated that well-trained health informatics workforce should know not only about healthcare but also about IT, business and management, communication and interpersonal skills. They should know as well how to cope with organizational change and project management [17-19].

We believe that Medical Informatics implies the integration of the following areas of knowledge: healthcare, computer science, healthcare information systems, management and quality indicators and epidemiology, biostatistics and decision making theory. Other areas include change management, project management, electronic health records, information retrieval, knowledge-based databases for clinical terminology and standards. The program aims to train human resources, that already have formal training in healthcare (mainly physicians), in the concepts and practice of computer science, to provide adequate knowledge of how healthcare systems work, healthcare management and also to acknowledge the importance of the adequate utilization of healthcare statistics for analysis.

Trainees actively participate in the development and implementation of an electronic health record so that they can also evaluate the impact these implementations have on healthcare in general.

The creation of the curriculum of the Medical Informatics residency program

at Hospital Italiano was based on these recommendations; it was focused on the health informatics specialist level with a curriculum leading to a qualification as specialist in health informatics. We believe that the combination of training provided by both training courses and the possibility of hands-on training is particularly useful. The possibility of applying academic knowledge in real situations with difficult scenarios together with the interaction with end-users in the use of health information systems is an important learning experience.

The increase in the number of students when comparing from 2006 to 2008 signals a growing interest in the development of health informatics.

Conclusion

Our 7-year experience of training residents in health informatics both in theory and practice has enabled us to obtain skilled human resources, which now play an important role in the development and maintenance of health informatics projects at our hospital. The growing number of students trained by e-learning keeps increasing, showing a worldwide need of knowledge dissemination in this field, which our institution is contributing to.

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Correspondence to:
Fernan Gonzalez Bernaldo de Quiros
Department of Health Informatics
Hospital Italiano de Buenos Aires
Gascon 450
1181 Buenos Aires
Argentina
Tel/Fax: +54 11 4981 5219
E-mail: fernan.quiros@hospitalitaliano.org.ar