Health Information Systems: Current Challenges and Developments

Findings from the Yearbook 2008 Section on Health Information Systems

C. Bréant, Managing Editor for the IMIA Yearbook Section on Health Information Systems
Department of Imaging and Medical Informatics, Geneva University Hospitals, Geneva, Switzerland

Summary

Objectives: To summarize excellent current research in the field of Health Information Systems.

Method: Synopsis of the articles selected for the IMIA Yearbook 2008.

Results: HIS is a broad field that includes many fruitful areas of research and development. Some current topics were selected for this IMIA yearbook.

Conclusions: The best paper selection of articles on health information systems shows examples of original developments in the area of: medical record systems to meet specific requirements in a developing country, methodologies to identify strengths and weaknesses of hospital information systems, networking of hospital information systems towards an integrated regional health platform, and development of an open source picture archiving and communication systems to facilitate the integration of advanced new imaging functionalities.

Keywords

Medical informatics, International Medical Informatics Association, health information systems

Introduction

The aim of health information systems is to contribute to a high quality, efficient health care, for patients, and medical research. This field is expanding, strongly influenced by modern information technology even though unevenly distributed among different income and ethnic groups[1]. Since the 1990s, advances in computer power and connectivity have created new ways to manage health data and diseases [2,3]. Due to the drop of costs, computing power is available to small healthcare clinics and average citizens [4]. In addition, this same computing power is available in smaller, mobile platforms such as the cell phone [5]. These will allow a sophisticated access to the internet where the cell phone will be used as a portal for health information, follow-up and monitoring [6,7]. Improved user interfaces have made interacting with information systems easier and more intuitive [8,9]. The informatics methodology and technology are expected to address new challenges such as continuous quality of care in aging societies, developing solutions to tackle specific health problems in developing countries, and opening novel opportunities for global access to health services and medical knowledge. Ubiquitous computing resources and networks, easing worldwide transmission of data, will permit to conceive new types of information systems and architecture for health care, including new kinds of health monitoring [10]. Health information systems have evolved during the last decade towards regional and nation-wide health network [11]. The focus has changed from institutional hospital information systems to eHealth supporting seamless availability of patient data across different health care facilities. Novel system architectures will include flexible IT solutions to support local specificities in order to ensure a federated access across health centers [12,13]. Moreover, many projects deal with the design of structured information models, networked data repositories, patient identifier services, as well as privacy, security and legal matters [14,15].

Best Paper Selection

The best paper selection of articles for the section 'health information systems' in the IMIA Yearbook 2008 follows the tradition of previous Yearbooks [16,17]. As a result of a comprehensive review process, four excellent papers published in 2007 were selected from peer-reviewed journals in the field of medical informatics. Table 1 lists the selected papers. This selection represents of course only a small portion of the world wide current research topics in the area of health information sys-

Table 1 Best paper selection of articles for the IMIA Yearbook of Medical Informatics 2008 in the section 'Health Information Systems'. The articles are listed in alphabetical order of the first author's surname.

Section
Health Information Systems

- Ammenwerth E, Ehlers F, HirschB, Gratl G. HIS-Monitor: An Approach to Assess the Quality of Information Processing in Pospitals. Int J Med Inform 2007 Feb-Mar;76(2-3):216-25.
- Bui A, Morioka C, Dionisio JD, Johnson DB, Sinha U, Ardekani S, Taira RK, Aberle DR, El-Saden S, Kangarloo H. OpenSourcePACS: An Extensible Infrastructure for Medical Image Management. IEEE Trans Inf Technol Biomed 2007;11(1):94-109.
- Durand T, Spacagna H, Verdier C, Biron P, Flory A. The Rhone-Alpes Health Platform. Methods Inf Med 2007,46(4):451-7.
- Odero W, Rotich J, Yiannoutsos CT, Ouna T, Tierney WM. Innovative Approaches to Application of Information Technology in Disease Surveillance and Prevention in Western Kenya. J Biomed Inform 2007;40(4):390-7.

tems. A short content summary of these selected papers can be found in the appendix of this synopsis.

Conclusions and Outlook

Last year's selection was mainly focused on telemedicine solutions for telecare and home care, the introduction of patient smart cards, the evaluation and acceptance of a new data acquisition device (digital pen), and architectural aspects of telemedical platforms and eHealth infrastructures [18,19]. The result of the selection process for this 2008 Yearbook section on health information systems includes four papers representing research projects carried out in four different nations. This selection indicates that medical record systems can be successfully enhanced to tackle health problems in a developing country [9]. It shows again this year that new architectures can be successfully implemented to federate many regional health care institutions [8]. The selection also mentions that assessing the quality of hospital information systems is still an important task that needs to be based on a standardized and carefully designed methodology [20]. The development of open source software is also

an important way to foster continuous research in well established fields such as picture archiving and communication systems (PACS) [21].

References

1. Reichertz PL. Hospital information systems-past, present, future. Int J Med Inform 2006 Mar-Apr;75(3-4):282-99.
2. Kuhn KA, Giuse DA, Lapao L, Wurst SH. Expanding the scope of health information systems - from hospitals to regional networks, to national infrastructures, and beyond. Methods Inf Med 2007;46(4):500-2.
3. Mykkanen J, Korpela M, Ripatti S, Rannanheimo J, Sorri J. Local, regional and national interoperability in hospital-level systems architecture. Methods Inf Med 2007;46(4):470-5.
4. Pereira J, Castro AF, Perez JL, Novoa FJ, Vazquez JM, Teijeiro J, et al. Development and implementation of a secure, integrated management system for medical images and electronic clinical records for small hospitals. Telemed J E Health 2007 Jun; 13(3):303-12.
5. Pohjonen H, Ross P, Blickman JG, Kamman R. Pervasive access to images and data-the use of computing grids and mobile/wireless devices across healthcare enterprises. IEEE Trans Inf Technol Biomed 2007 Jan;11(1):81-6.
6. Lee RG, Chen KC, Hsiao CC, Tseng CL. A mobile care system with alert mechanism, IEEE Trans Inf Technol Biomed 2007 Sep;11(5):507-17.
7. Jen WY, Chao CC, Hung MC, Li YC, Chi YP. Mobile information and communication in the hospital outpatient service. Int J Med Inform 2007, Aug;76(8):565-74.
8. Durand T, Spacagna H, Verdier C, Biron P, Flory A. The Rhone-Alpes health platform. Methods Inf Med 2007;46(4):451-7.
9. Odero W, Rotich J, Yiannoutsos CT, Ouna T Tierney WM. Innovative approaches to application of information technology in disease surveillance and prevention in Western Kenya. J Biomed Inform 2007 Aug;40(4):390-7.
10. Yusof MM, Papazafeiropoulou A, Paul RJ, Stergioulas LK. Investigating evaluation frameworks for health information systems. Int J Med Inform 2007 Sep 27 (epub)
11. Bott OJ, Marschollek M, Wolf KH, Haux R. Towards new scopes: sensor-enhanced regional health information systems - part 1: architectural challenges. Methods Inf Med 2007;46(4):476-83.
12. Raghupathi W, Umar A. Exploring an MDA approach to health care information systems development. Int J Med Inform 2007, Jun 6 (epub)
13. Lovis C, Spahni S, Cassoni N, Geissbuhler A. Comprehensive management of the access to the electronic patient record: towards trans-institutional networks. Int J Med Inform 2007 May-Jun;76(5-6):466-70.
14. Blobel B. Comparing approaches for advanced e-health security infrastructures. Int J Med Inform 2007 May-Jun;76(5-6):454-9.
15. Choe J and Yoo SK. Web-based secure access from multiple patient repositories. Int J Med Inform 2008 Apr;77(4):242-8.
16. Haux R, Kulikowski C, editors. IMIA Yearbook of Medical Informatics 2006, Methods Inf Med 2006;45 Suppl 1:S81-3.
17. Geissbuhler A, Haux R, Kulikowski C, editors. IMIA Yearbook of Medical Informatics 2007, Methods Inf med 2007;46 Suppl 1:15.
18. Despont-Gros C, Landau R, Rutschmann O, Simon J, Lovis C. The digital pen and paper. Evaluation and acceptance of a new data acquisition device in clinical settings. Methods Inf Med 2005;44(3):359-68.
19. Liu CT, Yang PT, Yeh YT, Wang BL. The impacts of small cards on hospital information systems-an investigation of the first phase of the national health insurance smart card projetc in Taiwan. Int J Med Inform 2006 ;75(2) :173-81.
20. Ammenwerth E, Ehlers F, Hirsch B, Gratl G. HIS-Monitor: an approach to assess the quality of information processing in hospitals. Int J Med Inform 2007,Feb-Mar;76(2-3):216-25.
21. Bui A, Morioka C, Dionisio JD, Johnson DB, Sinha U, Ardekani S, et al. OpenSourcePACS: an extensible infrastructure for medical image management. IEEE Trans Inf Technol Biomed 2007,Jan;11(1):94-109.

Correspondence to:
Claudine Bréant, PhD
Department of Imaging and Medical Informatics
Geneva University Hospitals
Rue Micheli du Crest, 14
1211 Geneva
Switzerland
Tel: +41 22 372 61 79
Fax: +41 22 372 88 79
E-mail: claudine.breant@sim.hcuge.ch

Appendix: Content Summaries of Selected Best Papers for the IMIA Yearbook 2008, Section Health Information Systems*

Ammenwerth E, Ehlers F, Hirsch B, Gratl G
HIS-Monitor: an Approach to Assess the Quality of Information Processing in Hospitals
Int J Med Inform 2007;76(2-3):216-25

The quality of both computer-based and paper-based information processing in a hospital information system (HIS) is an important factor for any health institutions. Yet, tools to analyze and supervise the quality of a HIS are often seen as insufficient due to the lack of standardized methods. This paper reports on the design of a comprehensive methodology that led to a careful design of a questionnaire for nurses, physicians and the administrative staff. It addresses not only IT aspects of a HIS but all information processing tools. As a result, HIS-monitor includes 107 questions to focus on how a hospital information system does to efficiently support clinical and administrative tasks. Questions were first developed by crossing process steps with general quality criteria. Then, questions were refined and tested. The results show that HIS-Monitor can help to identify strengths and weaknesses of information processing in a hospital from the point of view of directly involved staff members of the health institution. A thorough discussion of the results of the pilot version of HIS-monitor describes how it will be further refined in the future.

Bui AA, Morioka C, Dionisio JD, Johnson DB, Sinha U, Ardekani S, Taira RK , Aberle DR, El-Saden S, Kangarloo H

OpenSourcePACS: an Extensible Infrastructure for Medical Image Management
IEEE Trans Inf Technol Biomed 2007;11(1):94-109

The purpose of the OpenSourcePACS project is to provide an open source architecture for a picture archiving communication system (PACS), that can also support and integrate new functionalities emerging with the rapid evolution of the medical imaging field. This paper provides a detailed overview of the architecture of the system, describing technical aspects of the main components of the OpenSourcePACS project: the image order entry, the image server, the image viewer, and the reporting/viewing results. All modules were built using Java and open-source frameworks and application servers. An example of application of the open source PACS has been implemented to support primary care/specialist communication (between the requesting physician and the radiologists in a preliminary read). The majority of the code has been released to the open source community. The authors hope that OpenSourcePACS will foster new developments in PACS and recommend the system to academic and research communities.

Durand T, Spacagna H, Verdier C, Biron P, Flory A
The Rhone-Alpes Health Platform
Methods Inf Med 2007;46(4):451-7

This paper describes the Rhône-Alpes region health information system that connects a large number of health care institutions located in the south eastern part of France populated by 6 million inhabitants. The project included several directions which have ensured a successful project: 1) no system had to be rebuilt, but a direct connection to the system according to local computerizing capabilities was provided, 2) a bottom up model was used that involved key health actors (physicians), 3) an easy to use interface to retrieve medical information was developed. The architecture of the system and a corresponding functional scenario are detailed. The system federates re-gional health repositories and serves as a unique web-based portal to health information. A specialized component had to be built in order to set up patient identification on a regional basis. The iconic interface management system was built to provide a standardized view of all medical components organized along a chronological view. The system has received approval from the French regional authority. Due to the interest it generated, other projects will be incorporated and all healthcare facilities of the Rhône-Alpes region should be connected to the system by 2010.

Odero W, Rotich J, Yiannoutsos CT, Ouna T, Tierney WM
Innovative Approaches to Application of Information Technology in Disease Surveillance and Prevention in Western Kenya
J Biomed Inform 2007; 40(4):390-7

The surveillance, epidemiology, prevention, and control of injuries in middle and low income countries constitute a central but difficult health problem to address. This paper describes the first step in implementing a simple and inexpensive approach to generate accurate and timely information for patient care, monitor distribution patterns and develop targeted interventions for injuries in Kenya rural communities, where patients are hard to track and accurate information difficult to obtain. Hand held GPS devices are used to capture data regarding exact location of injuries, which is downloaded and linked to the patient medical database. Furthermore, the existing computerized medical record system has been enhanced by a geographical information system (GIS). As a result, existing medical record patient data, along with coincidental findings and spatial location analyzed by the GIS can identify areas of clustering of particulars injuries. As such, it can be used for targeting local injury prevention and control efforts. This is an original pilot system in which a general propose electronic medical record system was complemented to target a specific clinical problem in a developing country, in order to improve patient care, public health education, and research.