Health Information Systems

Course Program

Context

This document describes a PhD level course, corresponding to a Curriculum Unit credited with 5 ECTS (*Opção temática*), intended for the MAP-I doctoral program. It is offered by Serviço de Bioestatística e Informática Médica, Faculdade de Medicina, Universidade do Porto.

Course Description

Healthcare is information and knowledge driven. Good healthcare depends on taking decisions at the right time and place, according to the right patient data and applicable knowledge (1). Communication is of most relevance in today's healthcare settings, as health related activities, such as delivery of care, research and management depend on information sharing and teamwork (2).

Providing high-quality healthcare services is an information-dependent process. Indeed, the practice of medicine has been described as being dominated by how well information is processed or reprocessed, retrieved, and communicated (3). An estimated 35 to 39 percent of total hospital operating costs have been associated with patient and professional communication activities (4). Physicians spend over a quarter (5, 6) and nurses half (7) of their time writing up patients' charts.

A patient record is a set of documents containing clinical and administrative information regarding one particular patient, supporting communication and decision making in daily practice, and having different users and purposes (8). It exists to memorise and communicate the data existing on a particular individual, in order to help deliver care to him or her. Records are not only an information system but also a communication system, that enable communication between different health professionals and between the past and the present (9, 10). Patient records, the patient and published evidence are the three sources needed for the practice of evidence-based medicine (1). They are used for immediate clinical decisions (either by the author, or by others), future clinical decisions, quality improvement, education, clinical research, management and reimbursement, and to act as evidence in a court case (11).

Patient data quality in computer-based patient records has been found to be rather low in several health information systems (12-14). Most sources of poor data quality can be traced back to human error (13, 15) or bad system design (14). Moreover, the assessment of the correctness of collected patient data is a difficult process even when we are familiar with the system in which it was collected (16). One of the main challenges of health information systems or networks is to be able to gather the different parts of the medical record of a patient without any risk of mixing them with those of another patient (17, 18).

The proposed unit intends to be a specialization in health information systems (HIS), namely in the developing HIS, integration and interoperability issues,

terminologies, auditing and clinical data quality, and HIS evaluation.

Intro on PACS/RIS

References

1. Wyatt JC, Wright P. Design should help use of patients' data. Lancet. 1998 Oct;352:1375-8.
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3. Barnett O. Computers in medicine. JAMA. 1990;263:2631-3.
4. Richart R. Evaluation of a medical data system. Comput Biomed Res. 1970;3:415-25.
5. Audit Commission. For your information: a study of information management and systems in the acute hospital. 1995.
6. Mamlin J, Baker D. Combined time-motion and work sampling study in a general medicine clinic. Med Care. 1973;11:449-56.
7. Korpman R, Lincoln T. The computer-stored medical record: For whom ? J Am Med Inform Assoc. 1998;259:3454-6.
8. Wyatt JC. Clinical data systems, Part 1: Data and medical records. Lancet. 1994 Dec;344:1543-7.
9. Dick R, Steen E. The Computer-based Patient Record: An Essential Technology for HealthCare1997.
10. Nygren E, Wyatt JC, Wright P. Helping clinicians to find data and avoid delays. Lancet. 1998 Oct;352:1462-6.
11. Wyatt J. Clinical data capture and presentation. Medical Informatics Summer School2005.
12. Hogan W, Wagner M. Accuracy of data in computer-based patient records. J Am Med Inform Assoc. [Review]. 1997;4(5):342-55.
13. Hammond K, Helbig S, Benson C, BM B-S, editors. Are electronic medical records trustworthy? Observations on copying, pasting and duplication. AMIA Annual Symposium; 2003.
14. Hohnloser J, Fischer M, Konig A, Emmerich B. Data quality in computerized patient records. Analysis of a haematology biopsy report database. Int J Clin Monit Comput. 1994;11(4):233-40.
15. Weir C, Hurdle J, Felgar M, Hoffman J, Roth B, Nebeker J. Direct Text Entry in Electronic Progress Notes - An Evaluation of Input Errors. Methods Inf Med. 2003;42(1):61-7.
16. Berner E, Moss J. Informatics Challenges for the Impending Patient Information Explosion. J Am Med Inform Assoc. 2005;12(6):614-7.
17. Quantin C, Binquet C, Bourquard K, Pattisina R, Gouyon-Cornet B, Ferdynus C, et al. A peculiar aspect of patients' safety: the discriminating power of identifiers for record linkage. Stud Health Technol Inform. 2004;103:400-6.
18. Arellano MG, Weber GI. Issues in identification and linkage of patient records across an integrated delivery system. J Healthc Inf Manag. 1998;12(3):43-52.

Course objectives

The course aims:

- Make students acknowledge and describe the main characteristics and problems related to HIS development
- Provide the students with a tools to help develop HIS that are compliant with the best international practices of HIS development
- Help the student develop rigorous HIS evaluation methodologies.
- Provide the students a hands on approach to the PACS/DICOM universe

Course topics

1. Development of HIS
    a. To identify the need for an IS

   b. Implementation of HIS
   c. Electronic Patient Records
2. Integration and interoperability in HIS
   a. Standards (HL7, DICOM, OpenEHR, CEN TC/251)
   b. Semantic interoperability
   c. Integration of external services to the institution
3. Coding and classification
   a. Terminologies, nomenclatures and ontologies of clinical concepts
   b. International Classification of Diseases and the Diagnosis Related Groups
4. Auditing and clinical data quality
   a. Possible types of errors
   b. Methods for error detection
   c. Methods to increase data quality
5. HIS evaluation
   a. Levels of evidence
   b. Development of measurement instruments
   c. Demonstration studies
   d. Cost-benefit and cost-effectiveness studies
   e. Study planning
6. RIS/PACS
   a. Image demographics
   b. Architectures
   c. Image Distribution, Storage and Archiving Strategies
   d. Workflow e Dataflow in Radiology
   e. Critical Scenarios: Cardiac PACS
   f. Future: S-PACS (Surgery-PACS);
   g. Security and Privacy
   h. PACS and E-Learning in Medical Science
   i. PACS/RIS/HIS integration issues
   j. Regional PACS, Telemedicine and Telework
7. The DICOM standard
   a. History
   b. Standard: Storage and Communications
   c. Data Structure and data Encoding
   d. DICOM Services
   e. Workflow e Worklist Service
   f. Structured Reporting

Teaching methodology

- Lectures
- Lectures of invited speakers
- Practical implementarions of Health Information Systems or modules
- Integration of students on Research Projects

Evaluation Criteria

- 50% - A written final exam covering the topics studied in the learning unit.
- 50% - A written scientific article, concerning either results obtained during

their experimental work or a state-of-the-art review on a Health Information System topic, which must be presented orally in a public seminar.

Course bibliography

- H. Pardes , Harold P. Lehmann , Patricia A. Abbott , Nancy K. Roderer , Adam Rothschild , Steven F. Mandell , Jorge A. Ferrer , Robert E. Miller , Marion J. Ball. Aspects of Electronic Health Record Systems. Springer; 2 edition (March 21, 2006)
- Edward H. Shortliffe , James J. Cimino. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer; 3 edition (May 25, 2006)
- Karen A. Wager, Frances Wickham Lee DBA, John P. Glaser. Managing Health Care Information Systems: A Practical Approach for Health Care Executives. John Wiley and Sons
- H. K. Huang, "PACS and imaging informatics : basic principles and applications" , J. Wiley & Sons, 2004
- Keith Dreyer et al (eds), "PACS A Guide to the Digital Revolution", 2Ed, Springer 2006
- Herman Oosterwijk, "DICOM Basics Book ", 3rd Ed, OTech, 2005
- Oleg S. Pianykh “Digital Imaging and Communications in Medicine (Dicom): A Practical Introduction and Survival Guide”, Springer 2008

Teaching Staff

The teaching staff is composed by:

- Ricardo Correia (principal instructor), computer scientist, PhD in the integration of hospital IS, currently with 21 publications, teaching Health Information Systems on the Master course of Medical Informatics of the University of Porto, and whose current interest is Electronic Patient Records and Health Information Systems;
- João Fonseca, medical doctor, PhD in medicine, teaching Evaluation of Health Information Systems on the Master course of Medical Informatics of the University of Porto, and whose current interest include evaluation techniques and Patient Health Records.
- Augusto Silva, PhD in Electrical Engineering, is an Assistant Professor at the Department of Electronics, Telecommunications and Informatics of the Aveiro University and a researcher at the Institute of Electronics and Telematics Engineering of Aveiro (IEETA). Current research interests include medical imaging systems, medical image processing and PACS/RIS systems.
- Carlos Costa, PhD in Electrical Engineering is an Assistant Professor at the Department of Electronics, Telecommunications and Informatics of the Aveiro University and a researcher at the Institute of Electronics and Telematics Engineering of Aveiro (IEETA). Research activity is mainly focused in the area of PACS-DICOM (medical imaging systems and networks), Healthcare Information Systems including security and access control issues.