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Synopsis

Health Information Systems

Health care models are being increasingly influenced by the evolution of information and communication technology. The need to define more efficient health care models in the industrialized countries and the irreversible immersion in the information society is configuring a new health care delivery scenario. In this changing framework, health information systems are playing a crucial role to improve the accessibility to medical knowledge by health professionals offering specialized care services closer to the points of care, to assure patients their access to health care records at any time and place, to achieve timely outbreak detection and to create more patient-centered hospital information systems.

The papers selected in this section are good examples of the concepts and trends stated above, some of them aiming to demonstrate the benefits and success of Health Information Systems within future health care services. The first paper by Jacklin et al faces the difficult task to perform an economic evaluation of real-time teleconsultation services. The second work by Tsui et al is focused on computer-based public health surveillance systems for early detection of disease outbreaks. A review paper by Van der Meijden et al investigates the very interesting topic of the success of inpatient clinical information systems. Finally, Winter et al introduce to readers the importance of models and modelling tools for designing and building appropriate hospital information systems.

The access to scarce knowledge resources by any professional within his/her health care system outlines one of the most significant and classic themes of Telemedicine, whose most characteristic vision is a teleconsultation session. This telemedicine service is normally performed between a general physician and a specialist with the goal to get advice and support, regardless where the physician or the specialists are located. This interaction can take many forms; two examples: 1) a session of a radiologist and a neurologist both attending virtually, a tele-presence situation, a remote emergency site where a primary care physician is attending a traumatized patient, to make a decision on what to do by observing through video the patient and the images available, and interacting with the personnel at the patient side; and 2) a remote radiologist making a diagnosis from a radiological study made by a radiology technician, ordered by the primary care physician in charge of the patient in the health care community centre.

These teleconsultation applications, that typify the historical origins of Telemedicine, have been extensively implemented and reported in the last 15 years [1,2]. Over recent years the opportunities offered by multimedia and communication technologies have led to a significant increase of the commercial offer for video-conferencing, multimedia information handling and image processing that are the main components of any teleconsultation application.

Two main teleconsultation scenarios can be implemented: a real-time teleconsultation and a store & forward session. In the first case, real time implies that the two professionals are working simultaneously each one at his/her end of the teleconsultation link. In the store & forward method the information to support the consultation, notably the video and image material, are sent by the consulting professional to the reference site, where they are stored until the referred specialist decides to visualize and report them.

The clinical reliability of the technology for teleconsultation has been established but few studies have found evidence of the cost effectiveness of these telemedicine services [3]. In the first paper entitled “Virtual

outreach: economic evaluation of joint teleconsultations for patients referred by their general practitioner for a specialist opinion", Jacklin et al examines the impact of real-time teleconsultations to reduce cost to patients, reduce absences from work by patients and caregivers and the potential increase of costs into the national health services due to teleconsultation.

This thorough teleconsultation study involved two British hospitals in London and Shrewsbury and 29 general practices in inner London and Wales. The analysis based on total use of NHS resources over six months shows that overall the mean cost per patient was significantly higher in the teleconsultation group than in the standard outpatients group. Therefore the first authors´ hypothesis that teleconsultation would lead to cost savings was not demonstrated. These unsatisfactory results could be influenced by the short duration of the study (six months), the large costs of clinicians´ time, the possible underestimation of other beneficial consequences of teleconsultations and the broad inclusion criteria of clinical specialities. At the other hand, the implications of this study for patients were more positive as teleconsultations result in savings to patients in terms of costs and time. The current technological advances and the decrease of technology costs will envisage a better cost effectiveness scenario for teleconsultations in the near future.

Surveillance methods that can detect disease at an earlier stage are an important research direction for public health surveillance. In their paper "Technical Description of RODS: A Real-time Public Health Surveillance System", Tsui et al describe a health information system for disease outbreak detection. A public health surveillance system aims to collect and analyze data, almost in real-time, in a way that can be used effectively by decision makers. The data type most commonly used among surveillance systems is symptoms or diagnoses of patients from emergency departments and/or physician office visits.

RODS system uses clinical data that are already being collected by health care providers and systems during the registration process. The communication network between RODS and health care systems consists of virtual private networks and leased lines. Hardware-based routers are used for connectivity with the HL7 message routers. The system implements natural language processing to classify free-text chief complaints into syndromic categories and two detection algorithms for alert notification generation. These algorithms were not formally tested.

RODS has been in operation in Pennsylvania since 1999 and in Utah since January 2002 and a huge effort has been done to support and maintain the service. The research demonstrated the feasibility of a health information system for public health surveillance and the envisaged benefits of these complex information systems. Other outcomes of the RODS project were related with the establishment of the importance of HL7 message routers for public health surveillance.

The evolution of clinical practice, with much more chronic and non-inpatient clinical services, has set the stage for the evolution of hospitals [4]. A hospital information system (HIS) provides key information across the continuum of patient care for hospitals, outpatient clinics, and extended care facilities. Patient accounting, patient scheduling/tracking, and electronic medical records that include critical lab, pharmacy, and radiology information are essential elements to a healthcare delivery system that provides quality outcomes. These solutions integrate hospital services with outpatient care, payment services, and public programs.

Nowadays, there is a clear need to build hospital information systems to support personalised and patient-centered healthcare. Patients must benefit from innovative technologies and procedures that assure their access to health care records at any time and place. The hospital evolves into an organisation including multiple campuses and services of diverse types bounding by the creation of what is called a "virtual" hospital/health system.

Two papers have been selected for inclusion in this section of hospital information systems. A first one dealing with the analysis of success of inpatient clinical information systems and a second one devoted to the provision of tools for the design and implementation of the information system itself.

Despite the increasing number of available clinical information systems, very few evaluation studies have been published and no evaluation framework has been proposed for this specific application domain. The paper by Van der Meijden is a comprehensive review on evaluations of patient care information systems that require data entry by health care professionals published from 1991 to 2001.

The first issue investigated in this paper was to understand if a hospital information system was successfully implemented. This success depends on many factors such as the setting, the objectives and the stakeholders. The authors apply an existing framework developed by Delone and McLean for management information systems to categorize the attributes to assess the success of such systems. This framework includes several

success factors: system quality, information quality, usage, user satisfaction, individual impact and organizational impact.

The results of this study have shown the appropriateness of the multi-dimensional proposed framework to evaluate patient care information systems. In relation to the evaluation methods used in the literature examined in the paper, most of the evaluations reviewed were descriptive or correlational studies and only two of them included a comparative design with simultaneous randomized controls. Furthermore, most evaluations concerned systems in clinical use and were summative evaluations.

The fourth paper by Winter, Brigl and Wendt entitled "Modeling Hospital Information Systems (Part 1): The Revised Three-layer Graph-based Meta Model 3LGM²" aims to provide a terminology and ontology for designing a HIS and its intrinsic components. 3LGM² combines a functional meta model with technical meta models and is represented using the well known Unified Modeling Language (UML). This model is implemented by an appropriate software tool that is briefly presented in this paper.

Several information system modeling approaches, mainly designed for business process optimization, have been proposed and can be used for HIS modelling. However, most of them do not meet the needed requirements for the hospital problem domain. The 3LGM² meta model is carefully designed to bear a comprehensive set of requirements for modelling and management of a HIS. These requirements involve model enterprise functions and the tools supporting them, information modelling as entity types used by enterprise functions, the representation of function types in form of datasets, relationships between the enterprise functions and the tools and interworking of functions and communications between the tools.

The 3LGM² model is structured in three interconnected layers which provide a complete and helpful tool for modelling HIS. The domain layer describes the hospital independently of its implementation by its enterprise functions. The logical tool layer is focused on application components (application programs, software products, databases, communication interfaces and user interfaces). The physical tool layer is devoted to physical data processing components which are used to realize the computer-based and the paper-based application components.

Strategic information management in hospitals must be based on dedicated methods and tools. In this context, the design and development of a Hospital Information System (HIS) is a complex task in which a systematic approach requires a model for planning the information system and for directing and supervising it. The 3LGM² meta model is a good example of an effort to generate a useful tool to define a common terminology to be used for all agents (medical staff, managers, technical staff) and stakeholders involved in the process of HIS implementation.

References

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