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Hospital Information Systems

Though their mission remains much the same as before – to deliver healthcare, hospitals have changed considerably over recent years – both in terms of appearance and content. In the face of the emergence of the new e-Health environment, one of the clearest aspects of such changes is the evolution of the Hospital Information System, with accommodation to an ever-increasing number of anytime/anywhere data inputs and decision-ready information presentation requirements.

A modern hospital has to be recognised as a complex organisation which covers two main areas of activity: patient care on one hand, and the operational functioning of an institution on the other. The hospital organisation has also been continuously changing in character and requirements. Increasing interest in quality of care and a better control of costs based on a fixed-budget system permit (and in fact, increasingly require) a hospital to be market oriented.

Meanwhile, in Europe in particular, healthcare reforms have seen the organisation of the hospital itself evolving from a vertically integrated structure towards a set of specialised departments – each with its own clinical, as well as logistical, operational and administrative requirements.

These changes are steadily and systematically forcing hospitals to rely increasingly on computer-based information systems. This is the only way to collect, store, process, communicate, and present large quantities of data. These requirements can largely be met by a hospital information system (HIS).

The Hospital Information System: The Heart of the Healthcare IT Machine

The function of an HIS is to support hospital activities on operational and strategic levels. Particular functions of an HIS can be characterised as:

- Ó support of day-to-day activities
- Ó support of the planning and organisation of these day-to-day activities
- Ó support of clinical research and teaching through use of the HIS database (particularly important for university hospitals)
- Ó support of control and correction of planned activities and their costs, in view of agreement on medical and financial policies (usually called a management control). The means by which an HIS can meet such requirements depend on a variety of technical and organisation factors.

A hospital information system usually contains:

- Ó facility for the data storage (i.e. database)
- Ó facility to enter, retrieve, and edit data stored in the database
- Ó data communication facilities
- Ó facilities that enable the user to use the system.

Design and Implementation

The development of an information system, followed by its effective implementation, requires a close collaboration between the users (i.e. managers and physicians) and computer scientists. The first group creates favourable conditions, supply capacity and offer their knowledge of the subject matter, whereas the second group offers the knowledge of the technology to be employed and the software.

The collaboration calls for several phases. Information planning and definition study usually begin the project. Then, global design at the level of a system analysis and a system design prepare for building and testing the final application. Acceptance tests allow for implementation and clinical usage.

In order to maintain the quality of patient care in an efficient and cost-effective manner, a hospital information system needs to be created by interfacing and integrating many disparate applications. These applications will neither come from a single vendor nor run on a single server. Therefore, certain standards should be met at the system level and application level.

Electronic health information and services available over networks such as the Internet and related technologies such as digital TV/WebTV, wireless media including Web-compatible mobile phones and personal digital assistants (PDAs) open up new frontiers to medical activity able to redefine health care and change the physicians and patients requirements.

The Inherited Legacy

Systems designed in the previous century offer enormous storage space able to archive huge amount of information on patients accumulated in various healthcare institutions.

However, this creates many difficult problems to overcome in the design of new hospital information systems. Data management, extraction and processing of required information become a true challenge. The privacy of information has rapidly become both a legal and ethical issue, and the quality and reliability of information are also important issues in the hospital information systems.

On the other hand, patient care and administrative information can be communicated to authorised users in order to satisfy their functional requirements. Access to the patient information (both image and alphanumerical) at any time and place becomes more and more crucial.

It is required, for example, both at a patient bedside as well as access from outside the hospital. Web applications implemented on PDAs have begun to make such dreams real.

Moreover, authorised users may be provided with medical services through an unmodified web browser. This webbased environment should integrate patient records and allow the discussion of medical cases and promote remote opinion request and tele-consultation. The latter may be of particular importance in an emergency case that has occurred far away from a medical centre.

E-Health and HIS: Opportunity and Challenge

One of the biggest opportunities – and challenges – of e- Health and related developments is to bridge the gap between evidence-based medicine and patient-centred medicine. This requires an access to information about the advantages and disadvantages of all courses of actions.

In other words, two types of data have to be provided to

patients before they will be able to make a shared decision:

Ó First, the patient-related information which refers to the individual and the case (medical data, diagnosis, personal risk factors, etc.)

Ó Second, general information about the external medical evidence (effectiveness of different interventions for a given disease, recovery, possible risk, etc.).

Quality of information, including accuracy and completeness, is another issue to be solved. However, few could argue that such a process will lead to positive involvement by patients in the decision-making process of their future treatment.

To conclude, hospital information systems, as the hub of electronic health information and services must provide healthcare professionals with the necessary infrastructure to collaborate with their peers, share opinions, exchange clinical data, and access required information. An integrated HIS should facilitate the interaction and active participation of a large number of authorised users to satisfy functional requirements and evaluate the information repositories in the wider healthcare network to provide the greatest benefit for all patients.

The Hospital Information System

The hospital information system (HIS) has several parallels to a clinical information system (CIS), and some vendors still offer 'new' solutions as dual HIS-plus-CIS.

However, it is generally accepted that HIS (will) go further as a comprehensive, integrated information system which manages all clinical, as well as administrative, financial and other supporting operations at a hospital; recently, for example, some HIS offerings extend to clinical data warehousing and knowledge management for physician decision support.

Crucially, HIS systems should be open-ended – in other words, they must remain flexible to accommodate the emerging e-Health environment,

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including new standards, conventions and practices.

Given that HIS are part of a still-evolving framework, they must encompass both paper-based data processing as well as both legacy and new-generation IT systems or devices – and do this with maximal efficiency.

At the moment, it is not uncommon to find HIS systems consisting of a handful of core software applications with specialty-specific extensions (e.g dermatology, orthopaedics, dialysis, the OR, blood-banks etc.).

The HIS interfaces with existing sub-systems such as the Laboratory Information System, Radiology Information System, PACS, the hospital pharmacy and computerised prescription order entry. It is also integrated with bespoke IT platforms running in areas like the ICU, ambulatory/outpatient care, admissions, appointment scheduling and post-treatment follow-up, as well as in more traditional administrative areas such as payrolls and invoicing, procurement and supply chain management.

One of the most challenging issues concerns the communications component of the HIS, usually mediated by the Internet and/or dedicated Intranets, with state-of-the-art access controls and transmission security given as an imperative. This is targeted at communications among healthcare staff, the transfer of clinical information on patients between two or more hospitals/clinics for consultations or decision support, remote retrieval of up-to-date medical information, etc.

On the design side, there is a clear trend to structure new HIS systems in a multi-layered, modular matrix, as a 'federation' of distinct, autonomous applications which are each optimised to support specific requirements of different users and user groups. Indeed, the sheer diversity of individual hospital organisations across Europe, as well as the complexity of clinical protocols in use and the variety of preferences (many innate to specific healthcare cultures in different EU Member States) has made it difficult to conceive of a unique, 'monolithic' system applicable across the entire continent.

And yet, there are powerful forces for standardisation, not least in the shape of the emerging EHR (electronic health record). Indeed, one of the greatest challenges is to future-proof new HIS systems to the EHR and to the telemedicine dimensions of the e-Health environment.

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