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The bridge between administrative and clinical information system

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Abstract. On one side, physicians are asked to record administrative information, such as activity measurement, case-mix of their specialty, billing, for statistical, legal or reimbursement purposes ; and on the other side, they need to gather detailed information about their own patients in terms of clinical evolution, for the day-to-day care of the patients or for clinical research purposes.
Many other actors are also involved with these processes, both on the administrative side, such as registration officers, administrators and on the clinical side, nurses and other care providers. Applications have been developed within hospital information systems for capturing and disseminating information according to these specific actors and dedicated purposes. But more and more appears the need to integrate these data for insuring the coherence of information and avoiding redundancy of data capture. How to conciliate these objectives?
We describe the Geneva's approach for integrating the administrative and the clinical systems.

1. Introduction: what are the needs of a Hospital Information System ?

A hospital information system is logically a link between each patient element (administrative data, reports, lab results, images,...) and physically a network between machines and applications. A patient in a (teaching) hospital is geographically split, between its bed, the labs, the radiology department, or between hospitals and general practitioners, and split along the time. The link provided by the hospital information system is thus mandatory for putting together the scattered parts of the patient and providing a homogenous view.

The information handled within a hospital has to fulfil three types of needs: around patient care, for administrative purposes and towards an "across-patient" view.

1.1 Patient care

The first need represents the patient dimension. The care provider needs information about the patient ("how is my patient") : a view to the patient history, the medical reports (discharge letters, specialists and radiology reports, etc.), the laboratory results, the list of performed radiology examinations, operating room reports, the images, etc. Patients are considered one by one, during one hospital stay or along successive readmissions and ambulatory visits.

At the patient care level, major efforts are dedicated for data capture, in terms of performance (speed) and ergonomy of the man-machine interface.

The geographic view of the patient is itself more and more enlarged, with several aspects:

intrainstitutional, between several departments, such as medicine, surgery, radiology, or hospital and ambulatory care
extrainstitutional, including the General Practitioner or home care
extraregional, towards network of care.

Actors involved at this level are physicians, nurses, physiotherapists, etc., all people directly involved with the direct care of the patient.

1.2 Administrative purposes

The second set of needs may be defined as administrative, including activity measurement, statistics, billing and reimbursement. This category could also includes the need of optimizing a resource (i.e. reservation of an operating room) or ordering a resource (i.e. a laboratory request or a drug prescription order).

1.3 Several patients: the "across-patients" view

For taking his decisions about one patient, the physician needs also information about other patients. He requires information about the literature ("what does say the literature"), i.e. an access to MEDLINE for providing the bio-medical references. He may also require information about previously known similar patients "are there other patients who are similar to my patient?". In other words, if the Electronic Patient Record is primarily designed for being used patient by patient, i.e. for helping to take decisions about the patient in front of the physician, it should also participate to the elaboration of a more general medical knowledge, for treating other patients: "How the knowledge of one treated patient can be used for treating other patients?".

This "across-patient" view can be used at several levels:

at a demographic level (number of treated patients, age and sex of patients)
at rough diagnostic level (i.e. evolution of cardiovascular disease as reason of death)
or at a more clinical level (including details on severity of the disease, evolution of clinical findings and patient's outcome).

At the first two levels decisions are taken, maybe in terms of regional healthcare planning, or for creating a new hospital specialty. The clinical level is almost never used beyond the research purposes of one medical specialty.

2. Problems and issues around the Hospital Information System

The applications of a Hospital Information System may by viewed around several aspects, which raise specific questions.

2.1 Space view

Should the patient record be specific to a medical specialty or should it cover the intrainstitutional, extrainstitutional and extraregional views? At the beginning, administrative systems are more or less unique within a hospital, whereas clinical systems are dedicated. Physicians of one given specialty have the need to gather their own data, without the necessity to communicate data between departments. They often build their own database with their own vocabulary. After a few years come several problems such as archiving and security, and the need of getting the patient identification record from the central administrative system or the need of getting an access to laboratory data. Later

comes the need of getting clinical information from other departments (such as a patient going from a surgical department to a radiological examination or to a gastro-enterological examination, or for the child going from obstetrics to the pediatrics department). If these records should communicate, what are their specific parts and their shared parts? [1, 2].

It is the role of a medical informatics department to ensure a transversal view among departments. This need of a transversal medical record is even increased by ambulatory care, where all action around a patient (from investigation planning to diagnostic, therapeutics and further treatment planning) is to be performed during the reduced time of the encounter [3].

Clinical data are the most expensive to capture, because they are provided by physicians who have almost no time for doing it. The transversal view of these data is furthermore most important for avoiding redundancy of data capture, i.e. insure reuse of data.

2.2 Time view

How large should be the time vision of the patient:

how long should be watched the patient evolution and outcome: up to the hospital discharge or wider ? (We measured in Geneva canton hospital that among all patient treated during 1997 in hospital and ambulatory care, 18% were hospitalized once only ; all other had been seen several times in ambulatory or hospital care)

should we be able to read the medical records 10 years later ?

should we be able to keep a history of the evolution of a hospital (such as the creation of new structural entity, or the date of emergence of a new surgical technique that will undoubtedly modify the practice and the statistics)

what happens with the history of medical statistics when a new classification appears (which recently happens in Switzerland with ICD-10 ?)

Time also interferes with data capture, which can takes place:

before an event : for operation room reservation, for medication ordering or lab request

when the event takes place : admission of a patient, vital sign capture

or after the event : discharge letter, specialist report, statistical medical summary.

These implications are most important on the design of applications.

2.3 Level of detail view

How detailed should be the patient view? A formerly seen, the "across-patient" view can be built at several levels, demographic, diagnostic or clinical level. Up to now, healthcare planning decisions have been taken with information coming from the first two levels, but how far can we imagine that detailed clinical data could intervene in these decisions, specially when speaking of comparisons of patients between hospitals?

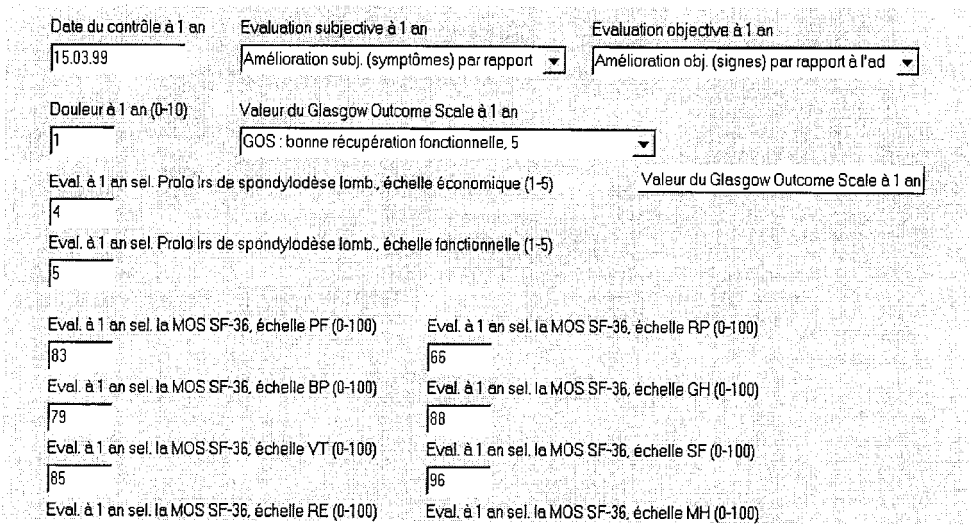

Figure 1: example screen of "detailed clinical data" application for neurosurgery

3. Geneva's approach as example of solution

Applications have been in Geneva historically mainly developed around actors and purposes. Nurses capture transfer and discharge information for activity measurement and communication purposes; physicians capture medical summaries for statistical purposes or they capture clinical data for research purposes; secretaries capture medical reports for patient documentation and communication purposes; financial employees capture acts information for billing purposes, etc.

DIOGENE Hospital Information System applications cover almost all hospital activities [4]. Each application is running on a transactional basis, i.e. they act as a natural way of communication between hospital actors:

ADT (Admission-Discharge-Transfer) is directly performed by the nurse when announcing a patient movement from the ward;

laboratory request is performed by physicians or nurses from the ward workstation;

UNILAB (UNIX-LABoratory) application handles the specimen from its arrival in the laboratory up to the edition of the result in the patient ward unit, even if the patient has been transferred;

an operating room procedure can be planned in advance throughout a dedicated application, PROGOP;

Pharmacy is directly ordered by the nurses, ward by ward. Individual drug prescription is under development;

Personnel is managed on a central application by each of the nine administratively independent units of the hospital.

Statistics on Intranet In order to constantly improve the quality of the HIS data, an immediate feedback is provided to the hospital actors be giving them statistics on a private hospital Intranet network. Statistics are available on an annual, monthly and even daily basis, about ADT, outpatient clinics, laboratory consumption, etc.

UNIDOC, containing the patient reports (discharge letters, surgical reports, specialists and radiology reports, admission notes, etc); Reports are dictated as usual by the physicians and typed by the secretaries [5].

Medical encoding in Geneva is directly performed by physicians, throughout a dedicated application called MODCOD, using a special tool for browsing the classifications, LUCID. Once entered, such a summary can be edited for being sent to the family physician, after appropriate signatures by the intern and the resident. The complete encoded history of the previous stays is available when a patient is readmitted, providing thus immediate and valuable information [6].

"Detailed clinical data": going further towards measuring quality of care requires more specific protocols for a given disease (cf fig. 1). Specialties have developed their own databases for capturing such detailed information. "Detailed clinical data" is an integrated application for capturing this information specifically to each department and also insuring a transversal view, i.e. sharing data between them.
OSIRIS, an image viewer, with an access to the PACS images (Picture Archival and Communication System).

3.1 Geneva's projects for communication between applications

Integration of these distributed applications has been developed in several directions. First, "integrators" have been developed, i.e. applications integrating data coming from several scattered sources. Such integrators are:

Archimed ; all patient applications save their related data within a common application called ARCHIMED ("ARCHIves MEDicales"). This application gathers all the DIOGENE patient-related data, beyond the actual archival process of each application (including pointers to texts and images). This powerful application allows to find "all facts of a given patient" and to retrieve "all patients matching to a given profile." [7]
Domed provides to physicians a common interface to the patient's documents (Unidoc reports, MODCOD summaries, histological reports and structured data coming from Archimed: patient trajectory, laboratory results, performed radiology examinations, histological summaries, etc). This application is mostly welcome among physicians.

Secondly, links between medical applications capturing data are under development. Data captured by physicians may be classified in three categories:

structured clinical data, such as "weight", or "temperature", or "Glasgow coma score", or "type of diabetic retinopathy"
diagnoses and therapeutics codes, corresponding to an internationally recognized classifications, such as ICD-10 or ICD-9-CM. These codes are able to generate a medical summary and statistics of the service, maybe based on AP-DRGs
free text, usually typed by secretaries as complete reports, but sometimes typed by physicians themselves as a short comment or conclusion of a visit.

These data are up to now captured in Geneva by three distinct applications: "Detailed clinical data", MODCOD and UNIDOC. But physicians ask more and more to record documents containing these three types of data altogether. The first idea was to build a new application integrating these functionalities. But each application contains specificities and is relatively complex. UNIDOC contains a sophisticated system for structuring texts into paragraphs, allowing to share paragraphs between documents, to build standardized texts for each medical specialties and to facilitate word indexation for free text retrieval. MODCOD contains mechanisms for checking the exhaustivity of summary, i.e. a mapping between the dates of the administrative hospital stays and the dates of the coded summaries, which mechanism being able to generate lists of un-encoded stays. The decision was then taken to keep the specificity of applications and to build communication mechanisms between them.

4. Conclusion

Applications within a hospital information system have multiple purposes and are used by multiple actors. Physicians themselves use applications dedicated to administrative purposes on one side and to clinical purposes on the other side. Having the intent to maintain the coherence of data and to avoid redundancy of data capture, tools for integrating these views are described. Furthermore, knowing that the patient's view becomes more and more wide across time and space (from the unique hospitalization to healthcare network), communication of detailed structured clinical information becomes more and more useful.

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