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Integration of Specialist and Ancillary Services System into HIS: Development and Implementation of a Generic Report System

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Abstract

A common characteristic of medical specialties within hospitals is the generation of reports of complementary studies carried out. Considering the importance of the primary capture of data, the easiest alternative is the generation of specific reports for each study or a single system for all of these reports in a free text fashion. The great disadvantage is the impossibility of terminological control, analysis, or systematic use of this information. Using a Clinical Data Repository makes possible to use data-driven systems that satisfy present and future necessities. By these means the Hospital Italiano of Buenos Aires toke a development initiative and the Generic Report System was created. It was successfully implemented in the following Areas: Endoscopy, Fonoaudiology, Imaging Diagnosis, Pathology, Cardiology and Telemedicine.

Keywords:

point of care systems, forms and records control, user-computer interface

Introduction

The complementary studies ordered by primary care or specialist physicians are carried out, in some cases, by providers or other professionals of the healthcare team. In other cases they are performed by complex equipment, with or without human intervention. Independently of the way in which they make these complementary tests, these ancillary services or medical specialties are so called Effectors Services. This services shape the obtained results of the test that generates the reports; and each effector has its own way to do this, according to the particular needs of each specialty. Further more, one effector can make several tests, each requiring different reports. Thus, we can find long narrative texts without structure, tables with measurements, graphics, waves, images, etc.; and all the possible combinations. In contrast, in a hospital information system (HIS) setting, involving every patient's healthcare aspect, the primary capture of data in the instances it's created is a key issue.

Systematic incorporation of reports with such dissimilar characteristics raises a considerable challenge. A possible alternative is to generate computerized reports, each one dedicated to the particularities of each specialty. It arises then what medical literature denominates SPIS (Specialties Information systems), which includes the LIS (Laboratory Information Systems), RIS (Radiology Information Systems), CIS (Cardiology Information Systems), etc. Another possible option is a more simple approach, which involves a single reports system that allow the creation of different reports in free text, having as a disadvantage, the impossibility of terminological control[1], analysis, or systematic use of this information. In addition to the limitations of each alternative, any modification, adaptation to new necessities, or incorporation of new technologies, in both, requires modifications on the software that supports them.

Due to this reality, we arrived to the conclusion that the true solution was to create an integrated and unique system, adaptable to each effectors service's needs.

Materials and methods

Scenario

The Italian Hospital of Buenos Aires (HIBA) is a tertiary care, teaching and research hospital with a 150 year old history. Since 1998 a full scale HIS has been gradually implemented, including ambulatory Electronic Health Record (EHR)[2]., inpatient discharge summary, administrative systems, scheduling systems, inpatient tracking systems, pharmacy systems and complementary studies report and visualization. Several health informatics standards had been implemented, including HL7, CDA Version 2, ICD-9CM, DRG, ICD10, and ICPC.

Considering our scope and thinking about a generic system of reports, we developed unique software capable of been used by the different specialties of the Hospital, adaptable to the very different requirements for different information types, not requiring new developments each time new needs appear, regarding different structured forms of representing data, able to use controlled vocabularies and standard codifications, integrated with the administrative processes as with the EHR, offering a user friendly and versatile interface, able to generate an electronic but printable report, and having the capacity of to gaining functionality

Therefore come into sight the conception of a completely data-driven system. This system was called RptGen, as abbreviation for Generic System of Reports. Its fundamental concept is indeed to be generic; a way of being able to cover the most varied reporting needs.

Operational model

Creation of the report

The RptGen system allows defining groups for input forms and visualization of information generated and presented to the user in real time; and storage and data recovery of these groups; tabular representation for queries, the way in which these are stored or modified; the flow through these forms as well as their accessibility according to different roles for security purposes, as the generation of printable reports, export of queries, use of Web Services, etc; the use of different APIs (Application Programming Interface) to interface with hardware devices or integrate with other applications; the presentation format, as well as the actions and answers to events that are required while being with the client.

Like this, diverse types of fields can be included, from simple data type: text, numerical, dates, etc. (for which validation ranks can be defined); to complex data type: multiple lists (for which its domain of origin can be defined). They can also contain images, with DICOM format; or electronic documents. The amount and combination of these fields are defined according to the needs and they can be grouped in labels, helping its presentation and functionality.

Operation

It can work like an independent application, offering all the functionality that is defined, or offering presentation services or some specific functionality to other applications, that can invoke it by Web. In our case, it is fully integrated with the EHR in every scope, which allows physicians to access the complete information in real time.

Data flow

When an application performs an administrative act, an event within it sends an HL7 message with the patient's identification data and the detail of the ordered test. An interface disaggregates the message and enters the request to the Rptgen for its later processing. At the moment in which the request begins to be processed, the RptGen sends a message HL7 indicating the state has changed (from "Solicited" to "In process") to the administrative application as to the EHR. When the request is completed, a message is sent indicating the change of state to Fulfilled. Another message is also sent to the EHR with the results and/or the report (CDA).

Architecture and technological model

The RptGen was developed in a Web architecture [3], Java (IAS- Oracle) and Oracle database. MQSeries (IBM) as messaging engine, HL7 V2.X standard for transactions and CDA for the clinical document exchange[4].

Implementation

With the objective of initiating a process that would include most of the Effectors, in July of 2004 the first implementation of RptGen began for Gastroenterology. With this implementation the system was tested and adjusted, and we began to confirm the versatility of its data-driven concept, that enormously simplified modifications and updates.

Few months later, before the end of 2004, it was implemented in the Audiology area. A great challenge aroused that had not specifically been planned when designing the system: the upload of the test had to display a previsualization of audiometric graphics as data was loaded. The printed report had to contain graphics with the curves and symbols (in colors) of the study, preserving the corresponding standards. It was then confirmed that the approach and the architecture of the system were the correct ones, since no modification or internal aggregate to the system were required to satisfy these requirements.

It was also implemented giving workflow support to the test processing in Cardiology, Pathology and Radiology.

Conclusion

Designing and developing this system allowed us to create an application able to adapt to the needs of the Effectors and each professional, according to the way in which they prefer to upload data. It is possible to choose a completely structured interface, as it is the case of audiometry; an intermediate model with structuration of diagnosis and tests, like in G.I. Endoscopy, or free text, as in radiology reports.

This, as many other applications, can be supported with no need for internal modifications to the system, thanks to the great potentiality of its data-driven design. Within a more ambitious project, it will be integrated with the PACS that will be implemented during 2007.

Finally, as the implementations advance we are identifying improvements that can be incorporated to offer new characteristics as to simplify present solutions. RptGen is in a continuous process of improvement.

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