

Information Technology For Medical Appropriateness Through Support Algorithms And Recovery Of Patients' Clinical History

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Introduction

In the health sector, the current intention of the Ministry of Health and of the Italian Government is to decrease healthcare squandering, to invest in research and to support the NHS. In this context the theme of appropriateness of treatment is essential; in fact the Health Ministry is committed to establish guidelines for the appropriateness of prescription, indicating the "conditions of provision" and "indications of appropriateness". A number of key actors however complain that this approach, along with others lead to uncertain and often ineffective results.

This work highlights how the adoption and use of Information Technology (IT) in clinical settings is contributing to the optimization of NHS resources and to the governance of the healthcare delivery activities, in particular for the management and control of appropriateness of care. As an example, the adoption of a computerized alerting system by the University Hospital of Parma has brought out significant results. System integration through standard protocols (such as HL7) and middleware (for instance Mirth), fully normalized data repositories that univocally identify patients, diagnosis and health service provided are crucial in the healthcare context.

Objectives

In recent years the Italian NHS has undergone budget cuts of more than 30 billion, with negative effects on research, on generational turnover of healthcare personnel, on investments in technologies and on the number of hospital beds. In fact, due to the reduction of more than 9000 hospital beds between year 2011 and 2012, the Italian NHS accounts for 3.5 beds per 1000 inhabitants, significantly less than Japan (14 beds/1000 inhabitants), Germany (8,2 beds /1000 inhabitants), or Austria (7.6 beds/1000 inhabitants) .

This factor has led hospitals to adopt a business profile, in which productivity and production costs are key.

It is now a widespread practice to outsource or concentrate services to rationalize resources and improve efficiency. Furthermore the Italian Government plans to reduce squandering through additional healthcare budget cuts, estimated up to 10 billion euro, to be invested in research, in healthcare efficiency improvements or in taxation reduction.

Is this approach appropriate to improve the quality of healthcare?

Technological development and Information Technology, although increasingly expensive, have on the other hand greatly improved healthcare delivery efficiency and have allowed a more precise definition and monitoring of appropriateness of care, through the use of models and algorithms. Proofs abound that these algorithms allow to reduce costs, by highlighting "unnecessary" health services in advance.

The purpose of this publication is to highlight and demonstrate the benefits achieved in health care by investing in Information Technology.

Materials & Methods

Government's approaches

(August 2015)

The intention is to implement the concept of medical appropriateness, by defining the guidelines for "conditions of deliverability " and "indications of appropriateness". Currently (August 2015) the first draft of the Decree concerning appropriateness of prescriptions foresees constraints on 180 health services in 7 main areas:

- Dentistry, Genetics, CT and MRI, dialysis, nuclear medicine, laboratory tests and allergology.

Health services that go beyond the deliverability constraints indicated by the caring physician will be charged to the patient.

IT solutions

Information Technology provides computer tools that suggest to clinicians the most "appropriate" therapy, improve the clinical approach and decision-making for the use of medications and treatment of diseases.

For instance the University Hospital of Parma has developed a computerized alerting tool based on re-testing intervals, linked to the order entry system, that generates pop-up alerts when 15 pre-defined laboratory tests violate the criteria of appropriateness.

The criteria are violated when biological plausibility is not respected or tests are repeated before the defined minimum intervals:

- C-reactive protein (CRP, repeat <24 hours);
- Glycated hemoglobin (repeat < 2 months);
- Beta-human chorionic gonadotropin (HCG beta; incompatible with age < 9 and > 60 years);
- Prostatic specific antigen (PSA; incompatible with PSA reflex and female gender; repetition <3 months);
- Thyroid stimulating hormone (TSH, incompatible with the TSH reflection; repetition <6 weeks);
- Protein Electrophoresis (repeat <7 days);
- Total cholesterol, high density lipoprotein cholesterol (HDL-C) and low density lipoproteins (LDL-C) (repeat <2 months);
- Brain natriuretic peptide (BNP; repetition <24 hours);
- Procalcitonin (PCT; repetition <24 hours);
- Ferritin (repeat <1 week);
- Vitamin B and folic acid (repeat <1 year);
- Immunoglobulin and albuminuria (repeat <3 months).

765 (22%) out of a total of 3539 requests generated by the departments of geriatrics of the hospital, between October 2014 and March 2015, have infringed the preset criteria and generated the alert pop-up. After the alarm, 591 requests were canceled (17% of the total and 77% of the alerted tests) allowing the hospital to save € 3387 in six months.

Once applied to the whole hospital, the system will "educate" doctors to the correct and effective use of laboratory tests, freeing up resources to treat those who need it most, besides generating significant cost savings.

Conclusions

The computerization and integration between the different Hospital Information System (HIS) components is essential in order to achieve effective results for medical appropriateness. In addition the use of an integrated virtual patient record available from any healthcare delivery location, appears a good solution to allow the dematerialization of documents and easy circulation and exchange of clinical information.

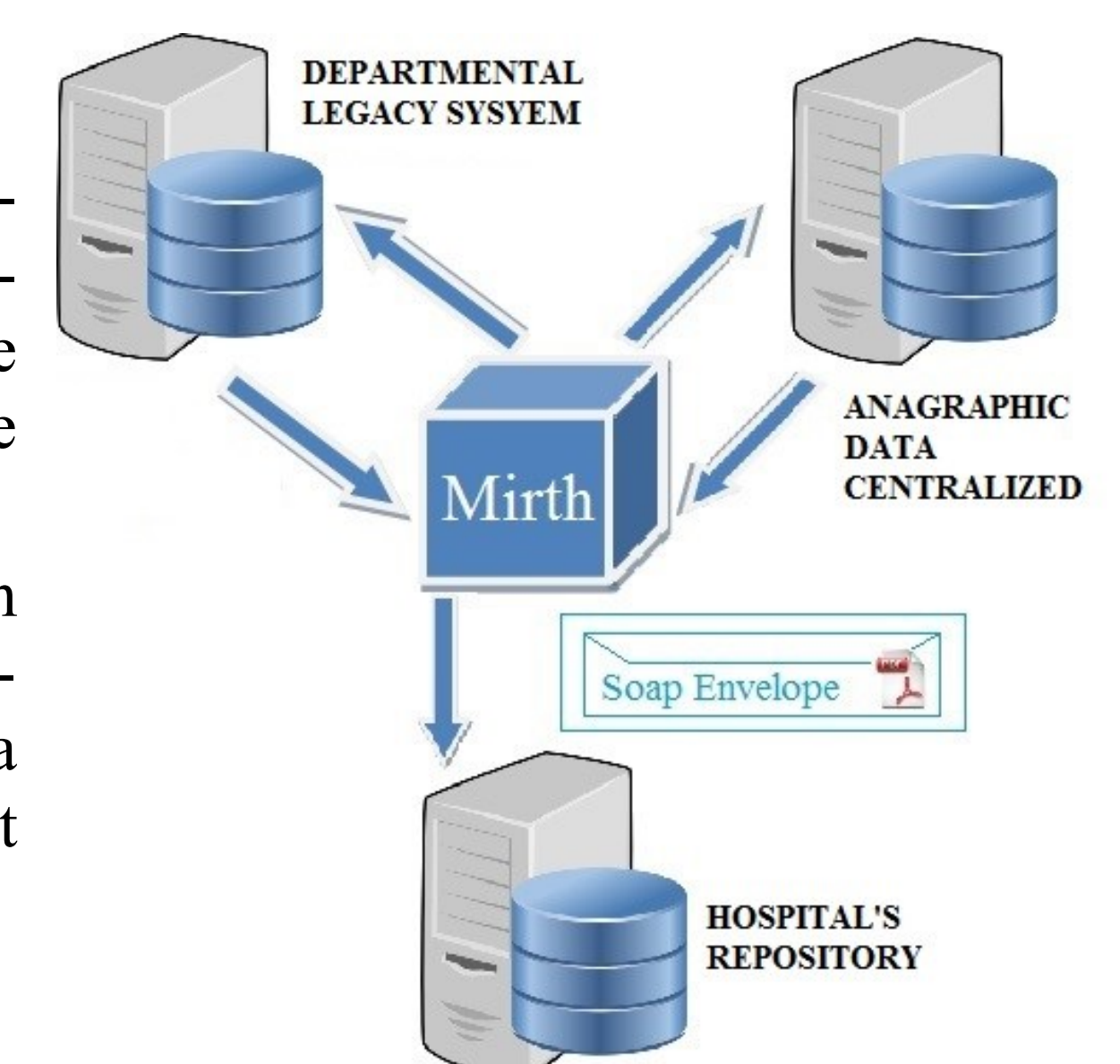
Usually Hospital Information Systems are rather fragmented and consist of isolated computerized structures including heterogeneous hardware equipment and software applications. Consequently the concept of medical appropriateness cannot be separated from the computerization of hospital activities and from the integration of these different health information systems.

The meaning attributed to messages must to be shared by both the sender and the receiver; an application that converts the intermediate information exchanged in a format common to all the health information realities is therefore required (for example from XML -> HL7).

An ideal solution for integration between health information systems is also the open-source Mirth software, developed in Java.

Mirth has therefore the advantage of managing the flows of information systems using independent channels. The latter will verify the conformity of messages in order to make them understandable by the listening systems.

The middleware is quite versatile and can in theory be used in any language for the exchange of information. It is the channels, via Java libraries or JavaScript commands, that will transform the message.



In summary, it is therefore essential to invest in information technology, in order to improve the management of health resources, to integrate the multiple clinical information, in the optics to provide an adequate health care to each patient (personalized medicine) reducing improper requests, as well as to obtain reliable information about medical exams through a simple web browser.

