The “LEGAME COVALENTE”
An Integrated Health Information System

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Abstract

The paper reports of an experience to improve continuity of patient care using an integrated health information system. The resulting software system was prized at the 2006 edition of the “FORUM PA Salute” (Italian Forum on ICT for Public Health)

1 From processes revision to a new generation of Health Portals

Primary and intermediate care are the basis of the Italian Social Health Care System. “Primary care” is the first point of contact of patients with the health service, “intermediate care” offers alternatives to the “hospital care” which is, and should remain, the level of acute settings. Primary care must remain as the level of chronic settings.

Patients are often seen by an array of different care providers in a wide variety of organization (private and public) and places. As a result we have a huge fragmentation of care. Instead we see that patients should remain at the centre of the whole process of care. With this goal in mind we have realized a system that permit any care provider:

• to control his state of health
• to assure information portability to other providers
• to receive alerts about patients (being admitted to hospital or discharged)
• to have information readily available at the right time and place
• to enhance continuity of care
• to pursue communication, cooperation and interoperability between different professionals

We regarded Health Processes as a controlled systems with feedback and followed this operational approach:

• process analysis with health care professionals
• process re-engineering activities
• design monitoring information system
• building a prototype
• building a data repository
• implementation

Of course, in social systems processes interleave in complex manners. The following is an excerpt from the global workflow of our Social Health Care Agency, namely that related to the “Discharge from Home Assistance”; each column is a process associated to a single actor/role of the global Agency.
**Dimissioni in Cure Domiciliari**

<table>
<thead>
<tr>
<th>Medico UO</th>
<th>Capo Sala UO</th>
<th>FAMILIARE</th>
<th>MMG/PLS</th>
<th>Segretaria Organizzativa CD</th>
<th>Medico di Distretto</th>
<th>Assistente Sociale</th>
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</thead>
<tbody>
<tr>
<td><strong>Valutazione clinica e proposte di inserimento in CD</strong></td>
<td><strong>Servizio CD non attivabile</strong></td>
<td><strong>Valutazione infermieristica</strong></td>
<td><strong>La CS illustra al FAMILIARE la procedura di accesso alle Cure domiciliari e lo informa che la SO prenderà contatti con la famiglia</strong></td>
<td><strong>NO</strong></td>
<td><strong>Valutazione del caso</strong></td>
<td><strong>Necessità di UVD in Ospedale?</strong></td>
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<td><strong>La CS dell’U.O. segnala la necessità di inserimento prima della dimissione del cliente a MMG/CD</strong></td>
<td><strong>Si</strong></td>
<td><strong>MMS VALUTA</strong></td>
<td><strong>Non acquisizione da parte MMG/PLS e comunicazione al Medico di Distretto</strong></td>
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<td><strong>Prima della dimissione del paziente</strong></td>
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<td><strong>Valutazione clinica e proposte di inserimento in CD</strong></td>
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<td><strong>UVD in Ospedale</strong></td>
<td><strong>PAI ed inserimento in ADI</strong></td>
<td><strong>Consegna Lettera Dimissioni a Segreteria CD</strong></td>
<td><strong>MMS compila richiesta inserimento</strong></td>
<td><strong>MMS compila richiesta inserimento</strong></td>
<td><strong>Consegna Lettera Dimissioni a FAMILIARE</strong></td>
<td><strong>FINE</strong></td>
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**Fig 1. Health Processes as a controlled systems with feedback**

The main components of our system are:
- Electronic Health Record
- System of professionals needs to guarantee continuity of patient care
- System of monitoring
- System of event-based controls that can modify the state of health of patients

It permits cooperation between professionals providers, districts, hospitals and citizens. It is able to monitor and control the care process of every citizen by improving efficiency and reliability of clinical processes. The “Legame Covalente” WEB-based information system may be used as a vehicle to exchange clinical information among providers, institutions, or other entities. It may also be used by the patient as a summary of his old and recent care. It is not a file of records but a different way to receive information and monitor the patient’s condition in real time. We need to organize and make portable a set of basic patient information consisting of the most relevant and timely facts about patient’s condition. Its most prominent features and results are:
- a communication system between citizen and doctors designed as an “Active System”
- a real-time alert system watching changes of patient’s status, based on SMTP, HTTP and SMS
• a collaborative environment between General Practitioners, Physicians and patients (read EPR);
• easy access to service providers (es: prescription and booking at the same time);
• paperless Social Health Care Agencies (hospitals, districts etc.)
• Internet Point Of Access to Health Services.

From a technical perspective the main specifications of the “Legame Covalente” are that:
• it is a WEB BASED architecture
• its backbone is based on a ORACLE 10G database
• it adopts HTTPS-secure http connection to provide authentication and encrypted communication
• it provides strong authentication by smart card to improve system security policy
• it adopts standard technologies and protocols to assure advanced interoperability and reliability
• it ensures data access traceability

This project is been implemented with the contribution of many health care professionals and some citizen health care associations as “Cittadinanzattiva”.

2. An overview of the Integrated Health Care Information System

Each of these actors (professional or not) have a their own conditioned access to the system:
• Family Physicians
• Home care
• Residential care
• Specialist care
• Hospital care
• Emergency care
• Laboratory and radiology test
• ...

The following is the General Practitioner’s point of access to the system.

[Image of the General Practitioner’s point of access to the system]

Fig 2. The General Practitioner’s point of access to the system
Fig 3. The communication menu between hospital and primary care General Practitioner

Fig 4. General Practitioners can monitor their patients even when they are at the hospital.
The family doctor (General Practitioner) inserts the patient's file that will be readable also by the hospitals. As a reward, he can read in real-time test results and control the state of health of his patients. He can also manage a pathology registry for any of his patients, and can collaborate with the specialists for the therapy.
Fig 7. General Practitioner collaborate online with specialists to adjust therapies for their patients.

Of course he can request health examinations and tests directly to suppliers:

Fig 8. General Practitioner request examinations for their patients.
Fig 9. General Practitioner manage both the Electronic Record of their patients.

Fig 10. .. and their Continuity Care Record ..
Citizens have their own access to the system:

Fig 11. .. so that it will be very easy to reconstruct online their anamnesis.

Fig 12. The Citizen’s Point of Access to the System.

And they can see their own Electronic Health Record
3. Conclusions

Most of our effort have been spent on redefining the workflow of the entire Social Health Care Agency, with all its processes seen as interleaving Controlled Systems with Feedback. As a conclusion we were able to build a new TCP/IP based Integrated Information/Service System for all the Agency. It include in a unique online accessible system all the actors of the Social Healthcare Agency. Integration is the key element and the strenght of this brand new approach to the monitoring and tracing of the patients health care status.

4. References