

Clinical Wall applied for Polypathological Patient Care

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Abstract—Polypathological patients have a complex health scenario that is not generally well addressed by traditional Electronic Health Record systems. In order to treat chronic diseases that these patients have, there is a need for coordination and communication among health personnel of different levels of care (primary care, specialty care, home care) and distinct profiles. Also these healthcare professionals will require to do complex interactions such make shared decisions within their collaborative work. To enhance this coordination among healthcare professionals, we propose the idea of "Clinical Wall" as a 2.0 tool that allows professionals to debate, share knowledge and make decisions based on the clinical patient information.

Keywords—Polypathological Patient; Continuity of Care; Web 2.0; Shared clinical decision; eHealth; Clinical Wall.

I. INTRODUCTION

One of the implications of aging, from the clinical viewpoint, is the fact that is increasing the number people with two or more chronic diseases. Likewise there are studies that affirm that number of diseases per patient has incremented in the last two decades [1]. The World Health Organisation calculates that 60% percent of global deaths are caused by chronic diseases [2]. As a result, there is a growing concern within the Public Health Services in developed countries about polypathological patients. For instance in Australia people with multiple chronic diseases represent 50% or more of the population with chronic diseases [3]. These patients are characterized by their high complexity and vulnerability with a large number of symptoms and high prevalence of functional impairment. As

a result, these patients are likely to be dependent on caregivers who support them in their daily routine [4].

Within the Andalusian region the fragility of the polypathological patients has been shown in fulfilled studies, verifying that in primary care up to 40% of polypathological patients have three or more chronic diseases, 94% are polymedicated [5], 34% have a Barthel under 60, 37% have cognitive impairment [6], over 60% need caregiver, and 40% of these have overload signs [7]. Most of these variables are related to the insufficient sociofamiliar [8], so it still tends to be a comprehensive assessment that includes clinical areas, functional, and sociofamiliar.

A. Integrated healthcare process

Integrated Healthcare Processes (IHP) Management is a central strategy for improving the quality of the Andalusian Health Service. These Healthcare Processes are based on the development of flexible organizational models and an appropriate management of the processes according to the integration of scientific knowledge and evaluation of their performance in healthcare environment. The IHPs are based on increasing the involvement of professionals in a patient centered assistance, ensuring clinical practice according to the available scientific knowledge, facilitating continuity of care, and evaluating the clinical results.

The IHP for polypathological patient care specifies the professionals who will take part in healthcare, as well as, their role in this process [9]. The polypathological patient, more than any other patient, requires sustained assistance in shared care between primary and hospital for presenting special complexity that often requires quick access to interconsultation, complex diagnostics and hospital

admissions . The answer to these needs has been the incorporation of a model of continuity of care based on collaboration programs between internists and general practitioners with the defence of the figure of the internist of reference for each healthcare centre. During the last years different practical experiences have shown that is possible to consolidate this model both at large and small hospitals. The following professionals are described in the IHP:

- General Practitioner participates on the identification of the polypathological patient in order to be included in this IHP, the Comprehensive Assessment, in the Continuing Assistance Plan (CAP), home care, and attention to the caregiver.
- Internist of reference on the identification of the polypathological patient in order to be included in this IHP, in the CAP, home care, and attention to the caregiver.
- Family Nurse. Participates in the Comprehensive Assessment, in the CAP, in home care, and in attention to the caregiver.
- Hospital Nurse. Participates in the CAP, in home care, and in attention to the caregiver.
- Community Liaison Nurse. Participates in home care, and in attention to the caregiver.

The following figure shows a summary of process architecture that takes place in the care of polypathological patients, extracted from the IHP:

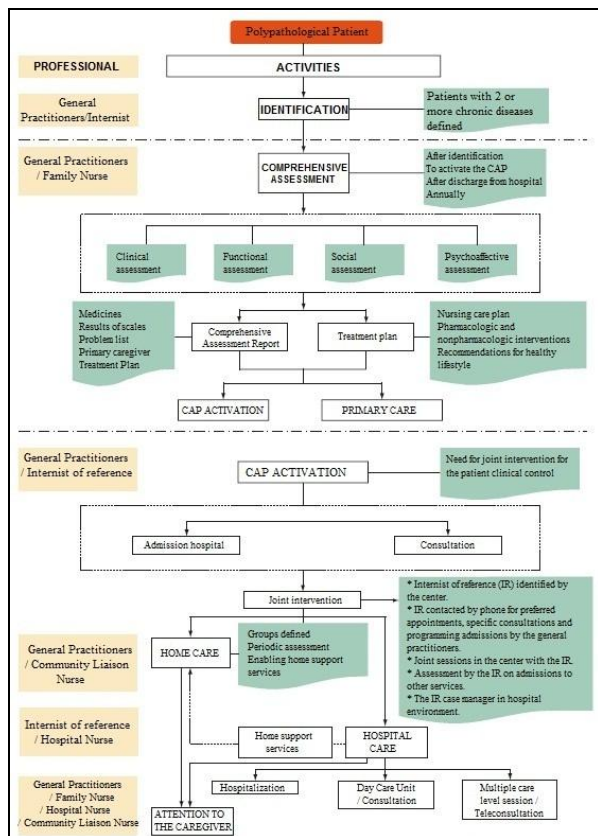


Figure 1. Process architecture: The care of polypathological patients

Just as is shown in the IHP, polypathological patient care involves many professionals with different roles and responsibilities. They must complement each other to obtain continuity of patient care across the different health centers of the region.

II. METHODS

“Virgen del Rocío” University Hospital (VRUH) is currently developing the *eHealth Platform*, a system able to deploy new services and pilots projects within the hospital environment. Within the project called *PITeS: Methods and Tools for Design and Implementation of Telemedicine and eHealth for the care of Chronic Patient*, a system called Polypathological Patient Module (PPM) is being developed to allow communication and coordination between the healthcare professionals involved in the polypathological patients care.

The platform is a complement to the Electronic Health Record (EHR) systems in use at patient care. The infrastructure currently deployed is composed by one EHR system in Primary Care and another different in Specialized Care.

Although there are some interoperability capabilities between these EHR systems, it is not possible to share all the patient information between the healthcare centers involved. For this reason, the PPM aims to facilitate the continuity of care accessing through Web Services the relevant patient information contained within the different EHR systems.

A. Clinical Wall

From the VRUH, we are working in order to enhance the EHR with tools that assist clinicians in their work in day by day.

The PPM includes the possibility to generate records that contain what we have called Clinical Wall. When two or more professionals have the need to exchange opinions about the patient care, they can start a conversation in the Clinical Wall. The Clinical Wall allows to exchange messages between healthcare professionals who participate on the patient care, until agree on conclusions or final decisions. If any of these healthcare professionals who participates in the Clinical Wall decides that is required the opinion of another colleague, they can invite these experts to the conversation to incorporate their clinical expertise.

The clinical dialogue hosted in the Clinical Wall is not for urgent communications. The platform will not be used in emergencies because there are other established protocols within the hospital to meet these events. In order to minimize the impact on the daily routine of healthcare professionals this system doesn't require real-time communication. The Clinical Wall dialogue allows sharing information between healthcare professionals to help them in the definition of coordinated therapies and prescriptions.

If the clinician who starts the conversation wishes to receive a response within the next 24 hours, he/she can activate an alert to notify via SMS to the healthcare professional who must answer this consulting.

Below, the figure shows a business process diagram designed to record information in the Clinical Wall report:

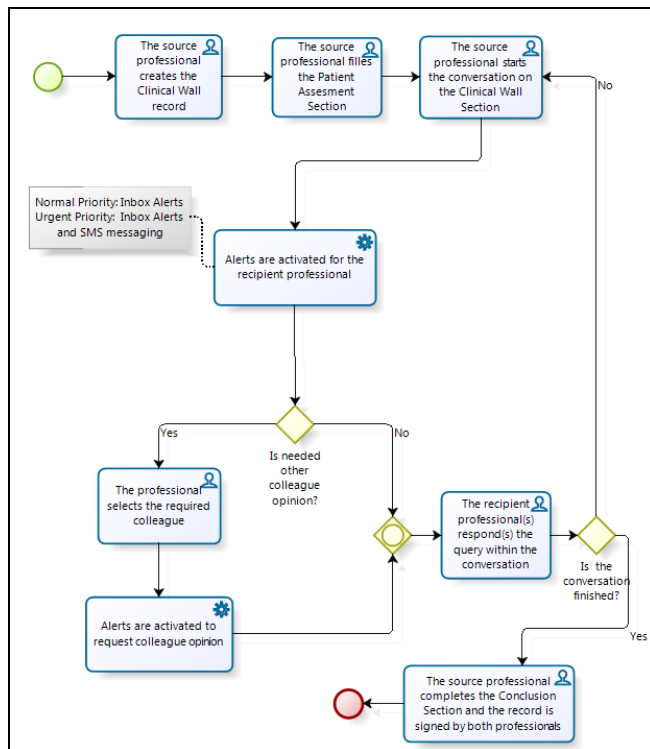


Figure 2. Business process diagram

The principal users of the platform will be the professionals described in the IHP as responsible for polypathological patient care. These professionals will use the platform within their daily routine so they should not receive SMS notifications.

Additionally, the platform will also give users access to specialists from various ailments common to these types of patients. For example, to questions related to cardiology and respiratory medicine will exist user within the respective departments of the hospital to evaluate and establish their clinical assessment. Because it is expected that these specialists don't have a volume of consultations as high as those included in the IHP, will receive an SMS alert showing them that have a new message in your inbox if someone have made them a consultation for them.

Furthermore, we defined interesting alerts that appear in a pending tasks box when the professional access to the platform. If you have urgent alerts will be sent an SMS to the mobile professional or professionals who are involved in the care of the patient.

B. ISO 13606 Standard

The platform has a relational database designed based on the specifications of the ISO 13606 reference model [10]. In this database are modelled all properties of the components of this model, establishing the corresponding relationships of the components from the archetypes repository. The ISO 13606 Standard defines a reference model defined for the

message exchange containing clinical information. In this model the clinical information to be transmitted is structured into extracts, which contain folders, which brings together documents, which are composed of headers and entries, and these entries may contain elements or groups of elements.

C. Archetypes

The definition of the Clinical Wall record is based on logical structures called archetypes. Archetypes are formal definition of semantic relationships between concepts defined as a set of constraints within an underlying reference model. [11]. Archetypes are able to define the relationships between the clinical concepts as a new layer that allows the management of clinical knowledge evolution.

A very important feature of the archetypes is their reusability. Archetypes define specific concepts such as blood pressure, body weight or body temperature. These concepts are useful in different health areas. Likewise, the archetypes of blood pressure or other concepts can also be reused in a multitude of health services and greatly reduce the costs associated with the implementation of this architecture [12]. Its application allows the development of easily-scalable systems and with semantic interoperability, designed to adapt to changing clinical needs of health professionals.

A set of archetypes have been defined in order to create a composition with 3 sections to record the dialogue between the clinicians.

Patient Assessment Section. This section is going to be filled by the healthcare professional that starts the dialogue with a clinical question. In order to provide patient clinical context for the colleagues this section includes patient evolution, examination, complementary tests, treatment plan and current clinical assessment.

Clinical Wall Section the name of this section is to illustrate the similarities with conversations in the wall of a social network websites where people exchange messages on a topic. The dialogue starts when the first healthcare professional wants to share or ask for additional information to other professionals who provide care to one specific patient. Other professionals can provide additional inputs and they will be stored as a conversation.

Conclusions section, participants can agree and sign their conclusions and future actions for patient care. Some possible outcomes from the conversation are changes in treatment plan, new appointment for hospital or GP encounter, schedule for additional tests.

III. IMPLEMENTATION

In order to separate information and knowledge the system architecture design has been based on the ISO-13606 standard. The system DataBase includes all the classes detailed in the ISO 13606 Reference Model and store archetypes that model the relationship between the information stored with the clinical knowledge. In this process we have applied LinkEHR for archetype edition

Our system also incorporates the ICEfaces framework based on JavaServer Faces (JSF) standard to create a separation between presentation and behavior. JSF provides

rich architecture for component state management, data processing event management and user login validation.

In addition, the system includes a productive persistence layer based on Hibernate tools. These opensource tools optimize the maintenance, performance and flexibility of databases.

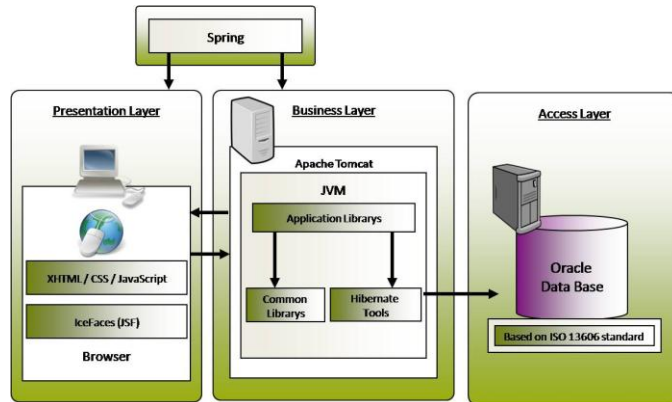


Figure 3. Platform architecture

IV. DISCUSSION

The platform expects to help in the complexity of polypathological patient care workflows allowing communication between the healthcare professionals involved and supporting interactions between the group actors that treat the set of diseases that affect every patient

This tool aims to support professional interactions that are not well handled by the traditional EHR systems because based on web 2.0 tools enables decision sharing among a group of professionals. The following complex interactions required in collaborative work [13] are able to be performed within the Clinical Wall:

- Confer: Healthcare professionals are able to discuss the patient situation with others colleagues before they make a decision
- Inform: Healthcare Professionals are able to notify others actors involved why they made a specific decision.
- Validate: Healthcare Professionals often require reviewing additional information to validate and support the decision they make.
- Assimilate or Share: Healthcare Professionals are able to share the decisions they are making or the information they have obtained, with the professionals involved in one specific patient care and the large community of professionals distributed to IHP professionals of the Primary Care and Specialized Care Centers.

On the other hand, given that polypathological patients suffer two or more chronic diseases, frequently is needed the participation of experts from different healthcare specialties.

It requires a fluent communication between all the professionals that are in charge of the patient care in order to provide coordinated care.

By being patients with chronic diseases, must take into account that polypathological patients will need a monitoring of disease throughout his life. Then, it's possible that the patient be seen by various professionals in the same specialty. An important aspect is to leave reflected the decisions taken on assistance in any record of the health record.

The platform and specially the Clinical Wall are going to increment the communication and coordination of the clinical staff. As a consequence it could be inferred that the security and quality of patient care will be improved.

Currently we are finalizing the development of the Clinical Wall. Next stage will be pilot the system in the VRUH environment. From the results of this pilot, the impact of the Clinical Wall on the patient care will be evaluated.

V. CONCLUSION

Traditional EHR systems don't provide enough support for clinical workflow needs. In the case of Polypathological Patients these needs increase because their treatment requires strong collaboration among different healthcare levels and specialties.

Our proposed Clinical Wall enables asynchronous communication among healthcare professionals within a collaborative work environment. This will improve the current clinical protocol based on phone communication for both urgent and non urgent information. The system will support the communication among healthcare professionals as a team and allow them a better workload administration because many interruptions by non-urgent calls will be avoided. Furthermore, the Clinical Wall will improve patient safety because it avoids interpretation errors caused by misunderstanding in phone communications.

We expect that evaluation of the pilot in our clinical environment could demonstrate the system benefits and extend the service to all the clinical specialties included in our hospital and a network of 36 primary care centres in our region.

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