

# Engineering clinical pathways to enhance the healthcare system performance

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## ABSTRACT

All over the world the health care services are facing the problems of rising costs while the quality of service is still unsatisfactory, despite the important work of practitioners and their staff. The numerous solutions adopted so far have hardly had a significant impact. A radically new strategy is emerging on the international level: to abandon a health care system centred solely on the activities of medical staff and on the "disease" in order to adopt a system centred on the "patient" and organized around his needs.

The idea is to shift the focus from volumes and profitability of services (visits, hospitalizations, procedures and examinations) to therapeutic results. The primary objective of all stakeholders involved in the Integrated Care Pathways (ICP) must be to improve the "value for patients", defined on the basis of therapeutic results achieved in relation to costs incurred to obtain them.

The paper describes the results of the "Clinical Risk management and Health Technology (CRIKHET)" project in the healthcare sector, which aims to implement, in public and private health facilities, a new methodological and technological approach based on ICT solutions in order to improve the quality of performance with sustainable costs.

The project is developing a highly flexible framework, based on a Business Process Management platform, that is able to define, integrate, coordinate, support, and monitor the clinical pathways. The platform enables the modelling of pathways and specific treatment procedures, allowing for the specification of activities, roles involved, service levels and events to be monitored. The pathway execution, carried out according the model, integrate and coordinate activities from different operating units, dislocated throughout the area, and from the perspective of the patient, who can interact with the healthcare staff by using mobile technologies.

The framework is applied to the management of cancer treatments and of home mechanical ventilation in order to capture and manage significant events, ensure compliance, monitor clinical risks, with the objective of controlling costs while providing the adequate quality to the patient. Experiences from the application of the framework are reported.

**Keywords:** Business Process Management, Clinical e-governance, Clinical Risk Management, ICT Solutions, Integrated Care Pathway

## 1 INTRODUCTION

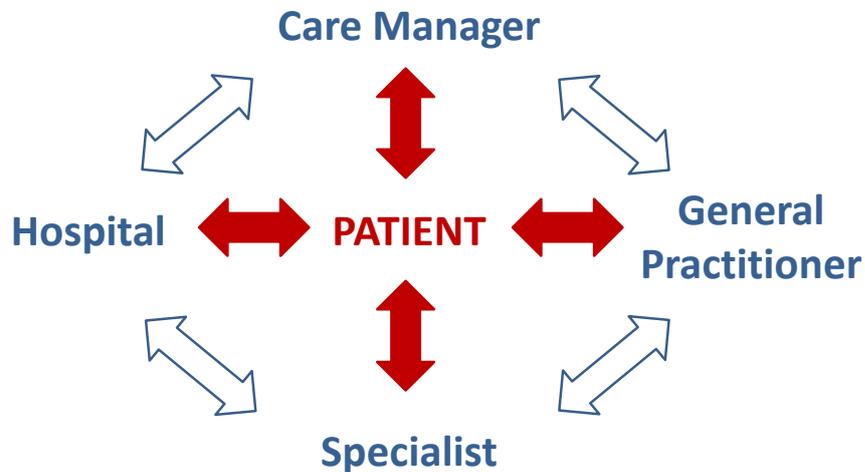
The Italian public healthcare administration is constantly aiming at reducing expenditures without affecting the essential levels of assistance (LEA) that must be granted to the population as defined by the Italian Republic Constitution and Italian laws regulating the institution and management of the national healthcare system (Ssn). Such LEAs ensure that all citizens have access to the healthcare services no matter what their economic conditions and lifestyles are. Obviously, this is a real issue in a general deteriorated economic context in which public administration spending reviews are reducing the availability of financial resources while the ageing of Italian population is getting higher and the life expectancy is increasing, thus generating a greater utilization of the healthcare system services.

This situation is even worst in the Apulia region where typical lifestyle of the population brings to an increase in chronic diseases (ISTAT, 2013). Data collected about health care expenditures in the region testifies that this category of pathologies has a very negative effect on the public finances.

Care of the chronic disease is thus one of the main areas where improvement initiatives can bring significant benefits in terms of lower costs, better control of resources, enhanced quality of healthcare service. Initiatives have been put in place in the Apulia region to shift the Chronic care to a new management approach that aims at improving the overall management of the patient's diagnostic-therapeutic healthcare pathway (PDTA) that is performed by hospitals and social and health districts

(DSS) under the control of the local healthcare public administrations (ASL). The approach is centered on the creation of a Care Team whose main role is played by the Care Manager, an health operator skilled to interact with the patient that acts as a bridge between the actors involved in patient's care.

Figure 1 Composition of the Care Team



The primary objective of the team involved in the Integrated Care Pathways (ICP) must be to improve the "value for patients" defined on the basis of the therapeutic results achieved. The following are the fundamental pillars that must be set for implementing the patient's centered approach:

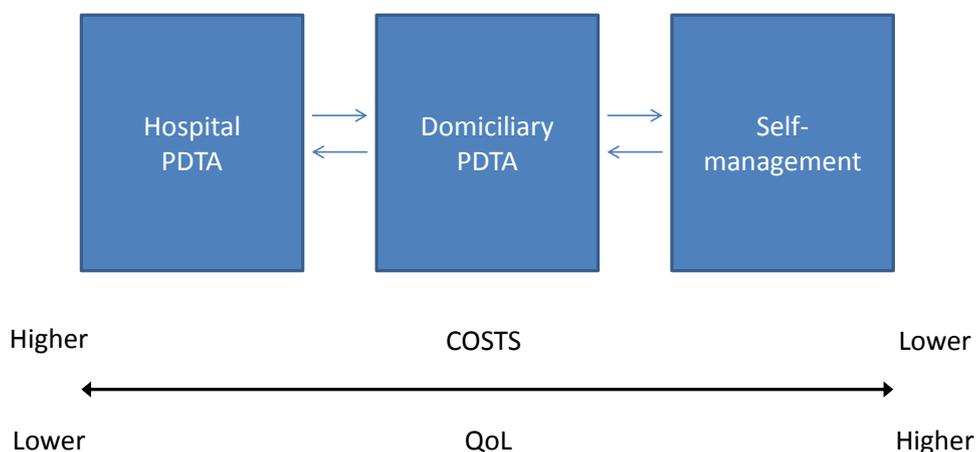
- Knowing how and when to contact the health service
- Conducting appropriately the therapy and examinations
- Knowing how to control the disease.

In this context the patient self-management ability and the monitoring and follow-up activities carried on by the Care Team assume a considerable importance for efficiency and effectiveness improvements of the services.

The objective of the paper is to present the results of a study conducted in the context described above where the implementation of a Business Process Management (BPM) framework, during the CRIKHET project, based on the support of ICT solutions, allows for the coordination of the monitoring and follow-up actions of the care team and for the proper satisfaction of the patient needs through the creation of a direct communication channel between the patient and the team and a health care service organized around the patient's case.

The BPM framework fulfils the recommendations from the Chronic care model (Barr et al, 2003) and the World Health Organization (WHO, 2002) that suggest a new organization of the Health System focused on the design of the delivery system supported by the adoption of Information Systems and the provision of Decision Support in the health care delivery processes, along with the support for the development of self-management capabilities.

Figure 2 Improvement directions for the Health System



The BPM framework helps supporting the new organization of the Health System aimed at reducing the hospitalization and at increasing domiciliary assistance (Sabato et al, 2010) by changing the way, the rules, the processes and the systems stakeholders use for collaboration.

Business Process Management (BPM) is a structured approach based on methods, policies, implements to define, optimize, manage continuously organization's activities and processes in order to create an efficient and effective corporate business and maximize value for the customer. BPM is a business management approach to align an organization business process with the requirements and needs of clients. It uses a systematic approach that relies on information technologies in the attempt to continuously improve business effectiveness and efficiency while striving for innovation, flexibility, and integration with technology. It can therefore be described as a "process optimization process". As a managerial approach, BPM considers management processes as strategic assets of an organization that have to be analyzed, managed, and improved in order to deliver value-added products and services to clients. (Harmon, 2004)

The BPM framework defined and experimented during the CRKHET project is built on three levels that address three different aspects of the Health System:

1. LEVEL 1 The System: the high-level view of the Health System services as a set of processes to be designed and controlled
2. LEVEL 2 The Project: the details of the specific health care delivery service, the requirements of the Care team for the service and the needs of the patient
3. LEVEL 3 The Process: the process organization for the service that is the procedures and the roles, and the required support from information technology.

The framework is aligned with the Total Cost Management (TCM) framework defined as "the sum of the practices and processes that an enterprise uses to manage the total life cycle cost investment in its portfolio of strategic assets", "a systematic approach to managing cost throughout the life cycle of any enterprise, program, facility, project, product, or service" (AACE International, 2012).

The BPM framework sustains the exploration of the three levels of the Health System in three subsequent phases:

1. in Phase 1 Project Launch, that maps the Strategic Asset Management process in (AACE International, 2012), targets and processes in the Health System are identified;
2. in Phase 2 Project Implementation, that maps the Project Control process in (AACE International, 2012), projects are initiated by involving the stakeholders, process requirements are gathered and solutions are developed and deployed;
3. in Phase 3 Project Operation, processes are continuously monitored and evaluated, long term benefits of the project are assessed and further improvements are identified.

This phases constitute the basis for the BPM lifecycle that is at the heart of the framework. The lifecycle is implemented by means of organizational and technological capabilities developed by the CRKHET project. The aim of the present research is to evaluate the role of the BPM framework, the lifecycle and the technological system, in enhancing the performance of healthcare projects and services.

This evaluation that is summarized in the lessons learned gathered during the project is conducted by analysing the ICT solutions elaborated for the two CRKHET scenarios concerning the management of Integrated Care Pathways in home mechanical ventilation and oncology.

The paper presents briefly the state of the art of BPM practices in healthcare and the specific environment of the CRKHET project, then the BPM framework is described and how this is applied to the health care services. Finally conclusions are drawn from the CRKHET experiences.

## 2 BPM IN THE HEALTHCARE

Changes in the health care industry are being driven by the increased costs and the growing demand for effective and appropriate care services. At the same time patients are becoming more informed, demanding and have greater expectations for value. Organizations have to redefine the path towards improved patient care. A cost-effective transformation of healthcare requires that stakeholders (both payers and providers) recognize and address the growing expectations for safety, value, improved care and access to drive a more patient-centric healthcare system.

Healthcare systems and organizations have been able to drive change by adopting process innovations that focus on improving interactions, outcomes and value. In the last years, we have seen the emergence of organizations adopting and leveraging a technological approach called Business Process Management (BPM) to achieve significant and improved results.

When healthcare organizations can combine structured processes with their specific data, business rules and analytics, they gain the ability to introduce operational visibility, support collaboration and

enforce governance structures, which in turn increases the quality and efficiency of the process and results in a powerful foundation for consistent customer interaction. (IBM, 2012)

Healthcare organizations are facing the challenge of delivering personalized services to their patients in a cost-effective and efficient manner. This, in turn, requires advanced IT support for healthcare processes covering both organizational procedures and knowledge-intensive, dynamic treatment processes (Reicher, 2012)

The use of a Business Process Management (BPM) can help support the implementation of medical best practices according to the national and regional guidelines and understand the patient progress along the dynamic care pathway.

Process-oriented health information systems define model guidelines, workflows or clinical pathways and they provide support for clinical decisions extending over time.

BPM consists of management processes, task timing, paths, routing decisions and roles based on task execution which can be mapped to the components of the ICP (Integrated Care Pathway) as follows: processes representing diagnoses and treatments, paths representing treatments flows; routing decisions are associated with clinical decisions concerning treatment and diagnosis. The different roles of people acting in the system are representing by the multi-disciplinary care medical teams.

The BPM terminology is mapped as follows:

- the ICP represents the business process, it defines the general guidelines which should be followed in the treatment path of a patient. These general guidelines are managed by a workflow management system;
- within the clinical guidelines there are more details of treatment stages which are included in the process definition. For each patient, a unique version of the process definition is created. These stages represent what actually happens in the process instances and are managed by a WFMS;
- each of these treatment stages are undertaken as different steps in the workflow, each representing an activity;
- activities within the treatment flow can represent a manual or an automated activity which, once it is activated, creates an instance in the patient's process instance.

BPM can become the bridge between health care providers and the team of professionals and technologies that can facilitate vast improvements in health care. A short list of improvements would include electronic health records, information-sharing in various organizations, medical processes and tracking medical history over time (Robinson, 2009).

An example of BPM application in the health sector is the reorganization process of Riyadh Military Hospital (Gold, 2012). The BPM system has helped to enhance the efficiency of health care delivery by improving health care interactions within a patient-centred interdisciplinary approach. It encourages many forms of partnership to support patient cares. A key factor in the success of a BPM system implementation is collaboration. A process-oriented application has to be modified whenever the business processes undertake changes. This process-oriented system allows clinicians to update, manage and change a particular treatment protocol. The challenges that the BPM system had to resolve regarding the Al-Wazarat Healthcare Center WHC (center associated with Riyadh Military Hospital) are summarized in the following list: longer patient waiting time, postponed or cancelled procedures, long treatment times, increased cost expenses, inability to determine task time.

The BPM project purpose was to map and automate the "core processes" of WHC. In term of business and operation structures, four main processes were automated, 6 structural sub-processes were created and 67 sub-processes were automated.

The main challenge was to deal with the complexity of the processes due to the wide number of areas, stakeholders and actors involved. To overcome the business and process challenges, it was necessary to develop the first stages of the project with special attention and detail on definition processes and architecture design. This made it possible to perform an effective process modelling for a successful implementation and execution. Moreover, the system transforming to a process-oriented application was an important factor to achieve the project objectives.

The benefits obtained from the use of BPM have been: optimization of health care spending, time reductions, increased revenues, productivity improvements.

The Al-Wazarat Healthcare Center WHC case shows that health care treatment processes benefit from the application of BPM systems as the activities of the complex processes that have to be managed by physicians is made explicit and their implementation enact and regulate the interactions of the health care staff.

But BPM approaches in health care need to couple technological innovations to the organizational transformations and to extend their scope to the collaboration between different healthcare organizations in order to increase their rate of success and provide value for the patients.

### 3 INTRODUCTION TO CRIKHET PROJECT AND APPROACH

CRIKHET (Clinical Risk Management and Health Technologies) is a project that addresses the issue of clinical risk management and it is financed by the Apulia Region as part of the "Apulian ICT Living Labs". The project, which includes the participation of IT network companies, research laboratories, and representatives of the Regional Health Administration, aims at creating a system for government processes and risk reduction with regard to the treatment protocols of clinical oncology and home mechanical ventilation.

Project activities are carried out in collaboration with the Apulian Regional Healthcare Agency (ARES) that is actively involved in the project and drives the innovation of the health services in the Apulia Region.

The aim of the CRIKHET project is to demonstrate the appropriateness of Business Process Management approaches, IT solutions and technological choices that are the basis to obtain the following objectives:

- improve the efficiency and effectiveness of clinical activities of the health professionals involved;
- reduce the risk for the patient regarding the occurrence of adverse events during treatment;
- collect and integrate feedback from the patient during treatment (patient "always in the loop");
- assess the pharmacological consistency compared to other therapies taken by the patient;
- validate the best practices implemented,
- monitor the patient clinical situation in the hospital and at home,
- coordinate the activities of the care team and follow-ups.

The CRIKHET system consists of a methodological approach to release the required improvements and a platform for the management of care protocols, a mobile application for home monitoring of patients and a Business Intelligence (BI) system available to managers and physicians for the evaluation of 'clinical and organizational appropriateness of care' and cost effectiveness. The validity of the system in the chronic disease care is verified through experimentation of protocols for home mechanical ventilation at the ASL (Local Healthcare Agency) of Brindisi and BT (Barletta-Andria-Trani) and at the oncology department of the "Giuseppe Moscati" Hospital in Taranto.

#### 3.1 BPM LIFECYCLE FOR CRIKHET

The CRIKHET approach is heavily based on the concrete design of processes and procedures that enable the delivery of health services as Integrated Care Pathways. Procedures or processes are cast in stone (in the BPM system) to ensure compliance to health care protocols but also to precisely identify points in which performances of the health system or service have to be monitored. As stated in the introduction, the priority set for CRIKHET is the delivery of new chronic care services in the Apulia Region.

The design and implementation of processes and services, that is new Integrated Care Pathways, is performed according to a basic BPM lifecycle that is made of requirements gathering, design of the process-oriented solution, deployment of the solution. Specific healthcare delivery processes are developed, or improved after the assessment of processes already in operation, in each iteration of the lifecycle based on the decisions taken at the beginning of the lifecycle methodology application, that is at the Project Launch phase (PHASE 1 mentioned in the introduction of the paper).

The approach is in fact based on several iteration of the lifecycle of redesign activities of the Health System that is coordinated at the top by ARES with the help of the CRIKHET project staff. During the the Project Launch phase, the following activities are carried on: identification and prioritization of the services to be redesigned, planning of processes and procedures for the service, identification of stakeholders and high-level requirements for the project, assessment of benefits that can be achieved. These activities are managed by the responsible organizations and the BPM system is used only for the processes already put under control whose overall performance are constantly monitored.

In every iteration that aims at developing the new service, the Project Implementation phase, the following activities are carried on: involvement of identified project stakeholders, detailed requirements gathering for the service, identification of peculiarities of the process that is health technologies and medical devices, events, risks and metrics definition, development of process solutions, implementation of pilot and testing in the real environment performed by end users. The stakeholders involved in the analysis of the service/process requirements and in the pilot implementation are selected by ARES in agreement with ASLs and DSSs managers.

During the Project Implementation phase the BPM system is exploited to shift from user requirements to the development of procedures that consists of:

- the design of the healthcare processes into the solution,
- the design of the organizations involved and the assignment of roles,

- the development of the interface with health technologies and external IT systems,
- the identification of the events and health risks associated to the process,
- the design of the performance indicators both from the health organization and customer point of view.

Table 1 BPM Lifecycle and System support for CRIKHET

Lifecycle Phase	Activity	Roles	Level of BPM System Support
Project Launch	service identification and prioritization process planning stakeholders identification high-level requirement definition expected benefits definition	Strategy Committee, Managers	Low
Project Implementation	project stakeholders involvement requirements definition roles assignment system interfaces development events and risks identification performance indicators design pilots implementation	Project Manager, Analysts, Developers, Users	Medium
Project Operation	process execution service monitoring and control performance evaluation	Managers, Users	High

The solution is implemented for running the pilot in the selected healthcare organizational environment, groups of healthcare professionals and patients are enrolled in the pilot implementation according to the required criteria of heterogeneity and technological maturity (patients or their care givers have to be able to access mobile technologies). Feedbacks and recommendation from users, that is practitioners and their patients, are gathered to analyse the pilot results, consolidate the solution and transitioning to the Project Operation phase.

In this phase a complete tested solution is available for the management of the service as an Integrated Care Pathway. Clinical pathways can be managed and monitored in the hospital environment and at home by means of the different system interfaces, desktop and mobile, with the collaboration of the different users, practitioners, operators, care managers and, finally, the patients. The process solution for the service has a built-in monitoring and controlling mechanism that allows for the monitoring of the service performance and the evaluation of profitability and effectiveness of the project implementation beyond the life of the project itself. The availability of the performance evaluation integrated in the lifecycle and in the system allows for the identification of further improvements required and the initiation of a new project implementation.

#### 4 CRIKHET SCENARIOS AND SOLUTIONS

The two scenarios for the CRIKHET project, the Home Mechanical Ventilation and the Oncology, are described in the following sub-sections with their respective solutions.

##### 4.1 Home Mechanical Ventilation (HMV) Scenario

The solution developed in the HMV scenario is based on a tool for Clinical Governance which avoids the risk of incorrect performance in a care process such as the allocation, distribution of mechanical ventilators and the coordination of follow-up activities with the patient.

The benefits of quality and efficiency introduced by the system regard organizational, clinical, technological and economic aspects such as reductions in human errors and in response time to critical events that allow for diminishing clinical risks.

CRIKHET supports the medical staff in the allocation of ventilators and patient monitoring; it controls all stages, prevents human errors that could affect the cost and the monitoring of assignments and

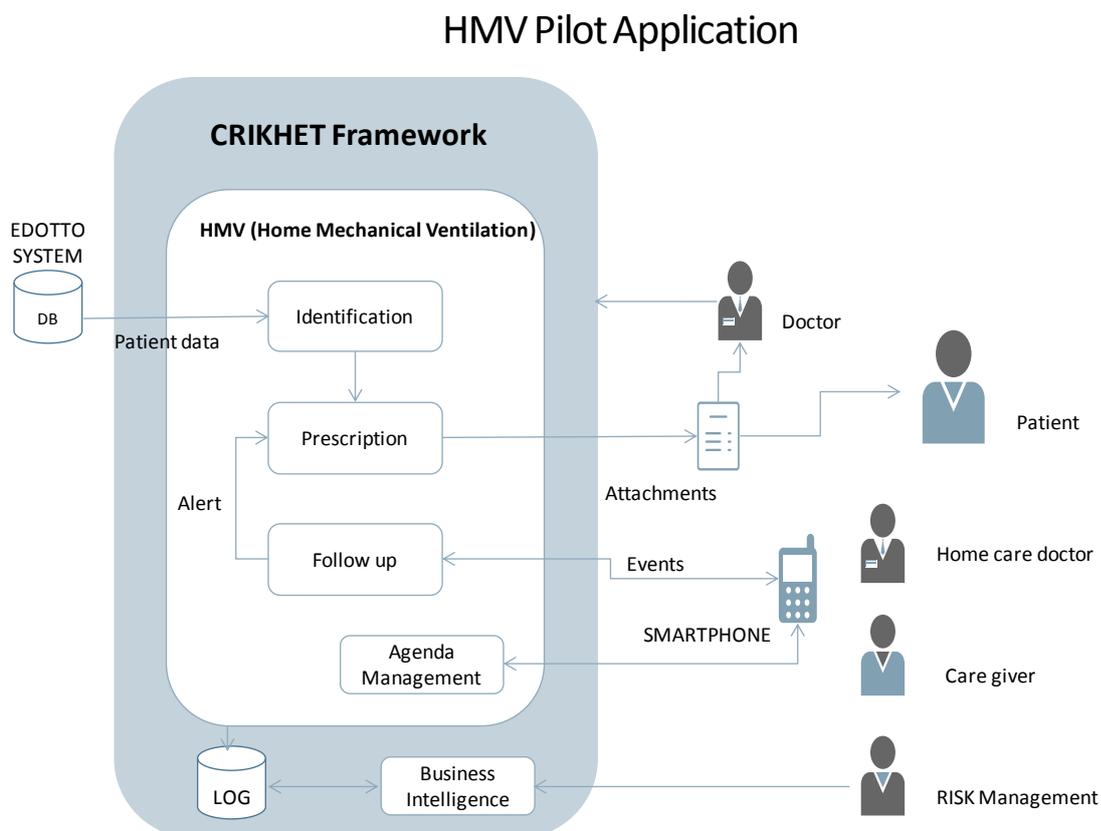
equipment from the economic point of view. Furthermore, the system enables the analysis of clinical information on the effectiveness of therapies and assets.

The CRIKHET system protocol for home mechanical ventilation consists of the following modules: a HMV module for patient identification, ventilation prescription and follow up; a mobile app and a shared agenda; and a BI module (management of Business Intelligence).

As regards the HMV module, and in particular the form of the "identification", an integration with regional 'EDOTTO' platform for the management of patient and physician personal data is provided. Finally, the system provides a log system characterized by a device of storing all the relevant information acquired during the process that will allow the implementation of reports and dashboards for the analysis of the functional data used by the BI management.

The figure below illustrates the CRIKHET system for Home Mechanical Ventilation.

Figure 3 CRIKHET system for home mechanical ventilation



The management of the care protocols for HMV can be divided into two processes which are called steps. The first step concerns the "prescription of home mechanical ventilation" while the second step concerns the "follow-up" phase.

Step 1 involves the registration of the patient personal and clinical data necessary for the prescription of ventilators, the creation of the request form for the required equipment, and the management of the ventilator delivery to the patient.

Step 2 occurs in a later stage, a "follow-up", in which different aspects, as the effectiveness of ventilation and adherence to treatment are verified and evaluated at fixed control points (first at three months, then every six months). The patient condition is monitored during the follow-up stage.

The following lists describe the detailed activities for each step, as previously presented.

Step 1 (Prescription of home mechanical ventilation) includes nine activities: inserting patient data, clinical patient data, patient gravity range, attribution of clinical care typology, fan choice, fan setting, delivery of necessary and optional equipment.

Step 2 (Follow up) has two tasks: control patient clinic conditions, and prescription and device verification.

Physicians and patients can interact using a mobile app which has been developed in CRIKHET and provides a value-added interaction with the patient and monitoring. The app has the following

functions: virtual healthcare provider, events communications, medical surveys or reports, remote assistance message, notifications to the patient and agenda management.

## 4.2 Oncology Scenario

Patient treatment is delivered through an Integrated Care Pathway (ICP) in a modern healthcare delivery model, where ICPs are “structured multidisciplinary care plans, which detail essential steps in the care of patients with a specific clinical problem”.

CRIKHET system contains the following modules: Integrated Care Pathway (ICP) with PDTA Hospital, PDTA Domiciliary, Agenda Management and Business Intelligence Management (PDTA is a diagnostic therapeutic healthcare pathway).

PDTA Hospital manages a set of coordinated activities with the objective of improving the internal levels of productivity and efficiency in the hospital.

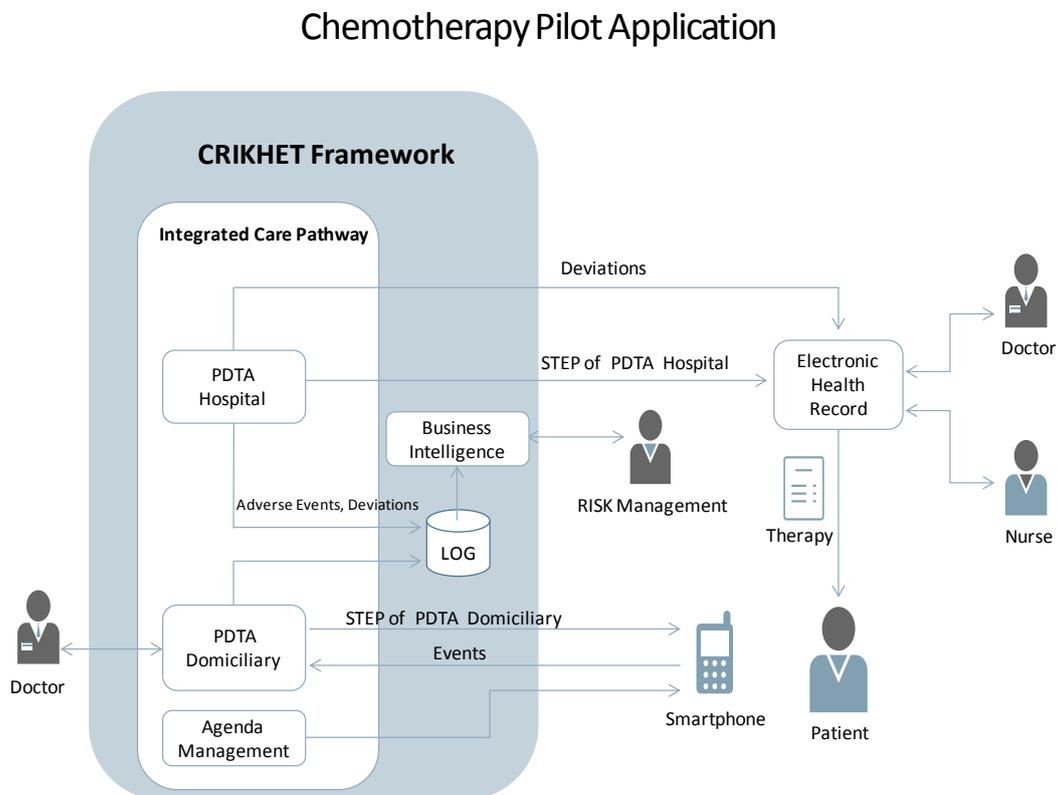
In particular, in the Oncology Department the CRIKHET system administer the chemotherapy treatment that generally provides a series of treatment steps in the short/medium term (cycles of chemo) that are rigorously planned.

The system implements the management of the different treatment protocols for lung cancer pathology that depend on factors such as histology, genotype, patient parameters (age, body surface area, etc.), the progress of the cancer; while a single treatment protocol is defined for mesothelioma pathology.

As previously indicated, the CRIKHET system is designed on clinical paths reference for lung cancer and mesothelioma treatment, the limit values in the administration of quantities, the recommended infusion rate and other control information.

Below a figure is highlighted showing the CRIKHET system architecture and the interaction between the various modules.

Figure 4 CRIKHET system for oncology



First of all the user inserts the information of a new patient in the medical record (access type, patient name, date and time) and related diagnostics. These data are automatically given to CRIKHET system along with the standard treatment protocol according to the relative diagnosis. The physician uses the functions of CRIKHET system to record all the customized therapy protocol (based on the parameters of the patient) and defines the personalized chemotherapy regimen. CRIKHET system reports any deviation between the detected "personalized prescription" and the standard chemotherapy regimen.

Health care professionals use the CRIKHET system in order to record effective drugs administration, adverse events reported during administration, vital signs.

CRIKHET system sends an "alert" in case of violation of chemotherapy regimen. At the end of the clinical episode a unique identifier for the proper process is delivered to the patient who can access to the system (PDTA Domiciliary; Agenda) for his/her home therapy.

All information acquired during the clinical course (deviations and adverse events) are stored on the CRIKHET Log system that will be accessible from all other modules of the system and in general from external information systems.

Besides the nursing care process, the patient can be treated and helped with a home care assistant.

New technologies in the healthcare can revolutionize the medical processes by carrying out a user-centric system in which the patient is always "in the loop". He will be more autonomous, more careful and conscious protagonist of his own health.

This model is performed with the use of new technologies and it has been developed in CRIKHET project experimentation with the implementation of mobile app. It will be able to manage a "to do list" for the patient with the mobile application, as well as to interact with the referring physician, to manage events, to send / receive messages, manage and view a calendar and make direct calls.

The patient will be able to record and report the occurring events to the physician or to the operators pool which can evaluate the relevance of the event based on the available information and record it on CRIKHET system. This information can contribute to the clinical evaluation and will have an impact on the decisions that the clinicians will take on the patient care path.

## **5 LESSONS LEARNED FROM CRIKHET**

The CRIKHET BPM approach has been adopted for the implementation of the two pilots described above. The BPM lifecycle has been used for the selection of the scenarios and for the development of the required solutions. The pilots are actually running in the three health districts selected with ARES for experimenting the solutions but some important remarks can be reported from the project execution up to now for the Project Launch (Phase 1) and the Project Implementation (Phase 2) phases.

### **5.1 Lessons Learned from Project Launch**

The Project Launch phase has registered the involvement of the Regional Health Agency (ARES) and some local health departments that was originally included in the CRIKHET project proposal.

The role of ARES, that acts as a coordinator of the local health organizations, with its capability to collect and analyse data from a global perspective is fundamental for identifying the required innovation and improvements of the regional health services. But the path to go from the Launch to the Implementation phase can be very slow because of the bureaucratic procedures to start the Project Implementation or to shift to pilot implementation, if managers of the ASLs and DSSs are not properly involved in the Launch phase.

Improvements projects are really supported if international, national or regional directives exist that prescribe clearly behaviours of the health organizations. This increase the likelihood of a successful requirements elicitation in a field where requirements are difficult to be made explicit.

### **5.2 Lessons Learned from Project Implementation**

The Project Implementation phase has registered the involvement of the two health districts and of one hospital.

The time and effort required to effectively involve the different teams along the project and pilot implementation has been very high. Objectives of the project had to be communicated again and again to stakeholders whose involvement was captured during the Implementation phase delaying the pilot launch. Requirements have been added along the way enlarging the scope of the solutions.

Commitment is difficult to be obtained even when sponsorship comes from the top management. Useful add-ins for the end user have to be integrated in the solutions to satisfy specific user needs that solve day-by-day problems or new hardware has to be provided to incentivise the piloting of the system.

The availability of a direct communication and a shared coordination with the patient has increased the need for legal protection for physicians in the case of message exchanges and notifications received directly from the patients.

Good news come from the global efforts on the process solution developments. Requirements from processes, protocols and treatments was directly transferred to developments from the process design simplifying and speeding-up the solution development. This enhancement has been possible where the definition of protocols was standardized by directives and regulations or when there was consensus on the behaviour to be implemented. In other cases the work on requirements has proceeded at the usual pace.

Another important improvement of the BPM approach is that the process solution developed for the service became an integrator of the several ICT systems that health care organizations have to use for storing information about patients and treatments. These systems are usually not connected.

## 6 CONCLUSIONS

As a conclusion the Business Process Management approach in the cases that have been developed and analysed during the CRIKHET project has evidenced various benefits for health organizations and patients.

From the point of view of the adherence to health care requirements, the CRIKHET system:

- ensures higher patient safety and reduction of undesired outcomes
- allows for reducing risks and costs associated with manual administration of medication and prescriptions
- offers clinical alerting applications to notify physicians of abnormal results and to interrupt the treatment administration promptly
- tracks the advancement of the treatment procedures
- generates reporting errors that provide a better understanding of where errors occur and how much they cost
- allows for the collection of data that support clinical decisions and reporting of physician and decision makers.

The CRIKHET system has the objective to achieve a significant improvement in the management of Integrated Care Pathways. The effective interaction and coordination between different healthcare organizations and departments as well as between healthcare providers and the patient helps delivering a faster and high quality patient care.

Healthcare companies should be able to perform their job more efficiently by eliminating manual tasks, by improving process visibility and control.

From the point of view of the improvement of TCM practices, the CRIKHET BPM approach represents a methodology supported by a system that:

- ensures the implementation of agreed, compliant and affordable healthcare organizational processes
- defines a set of guidelines allowing for the effective management of the Health System.

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