

# K4CARE

## Knowledge-Based Home-Care eServices for an Ageing Europe



**An integrated knowledge-based intelligent technology is being made available to help in the management and provision of health care services to chronically ill patients anytime and anywhere through the Web.**

### Social Need

The care of chronically ill patients involves life long treatment under continuous expert supervision. Admission to hospital and residential facilities can be unnecessary and even counterproductive, and could saturate national health services and increase health care costs.

### An ICT Health Care model to increase efficiency & quality

Efficient and quality health care management is achieved with a model that not only organises health care according to national and international standards, but also allows the adaptation of the model to specific health care systems, the extension of the model with new services, and the update and upgrade of services already provided.

This health care model is organised at the level of actors, by defining the actions allowed to each actor, and at the level of services, by defining the procedures that implement each service as a combination of actions and document accesses.

The result is a formal model evaluated in eight EU countries (i.e., Czech Republic, Finland, France, Hungary, Italy, Romania, Spain, and UK); which is modular, incremental, scalable, adaptable, updateable, standard-driven, knowledge-based, and computable with ICT.

### Organising Data with an Electronic Health Record

All the documents (e.g., requests, authorisations, prescriptions, scales, laboratory results, etc.) in the health care model are XML files, which are managed by a sophisticated relational database that also stores information about the actors (i.e., health care professionals, patients, relatives, etc.), roles, groups (e.g., evaluation units) and relations between actors (e.g., who the family doctor for a particular patient is). Each

sort of document in the Health Record is formalised by a XML Schema that

prevents the system from incorporating wrong documents, and a couple of XSL files allowing the documents to be shown or filled through the Web.

### Organising knowledge with Ontologies and FIPs

An **Agent Profile Ontology (APO)** formalises all the concepts and constraints of the health care model so that any modification of the APO represents a change in the model and an automatic and immediate adaptation of the ICT system operation. The APO knowledge about actors, services, etc. is complemented with a formalisation of the procedures that implement the health care services of the model (e.g., comprehensive assessment, nursing care, follow-up, etc.), represented as health care algorithms with the SDA notation.

The medical knowledge related to fifteen common chronic diseases was distributed between the **Case Profile Ontology (CPO)** and a **library of Formal Intervention Plans (FIPs)**. The CPO gathers all the concepts and interactions of these diseases at the levels of signs and symptoms, syndromes, means of assessment, social issues, and interventions. FIPs formalise the therapies of these diseases and syndromes as medical algorithms in SDA notation.



*A web platform provides health care professionals, patients and citizens a safe access to continuous long term care information, knowledge and services.*

## Personalisation of care

The system implements three different sorts of personalisation: user, patient, and treatment.

The **users** of the system are: health care professionals, patients, and citizens in general. Professionals can be of several sorts (defined as a hierarchy in the APO): physician in charge, family doctor, head nurse, nurse, social worker, etc. Each user in the system has a modifiable default profile obtained by automatic personalization of the APO that avoids a nurse for example starting a service or accessing a document not allowed to nurses.

The information in the Health Record is used to personalise the health care knowledge of **patients**. This personalisation adapts the general CPO to each single patient. This personalised knowledge helps users of the system to make decisions for that patient (e.g., detecting contraindications).

The FIPs of the diseases of one patient, together with the procedures of the services started for that patient are personalised and semi-automatically combined to provide an **Individual Intervention Plan (IIP)** for that patient. This unified IIP, formalised in SDA notation, is the treatment plan that the ICT system uses to automate the coordination of human resources around that patient.

## The ICT system

The Electronic Health Record, the ontologies, the FIPs, the procedures, and the personalisation automatism are combined in an Internet-based ICT system (**K4CARE Platform**) that is implemented using a combination of cutting-edge technologies such as JADE Intelligent Agents, Ajax-based web interface, OWL ontologies, Machine Learning, and XML-based Electronic Health Care Record.

## Validation

A successful and efficient implementation of the K4CARE Platform was followed by a double validation. The first was performed in the health care centres taking part in the project and the second, in Pollenza (Italy). These validations confirmed the general satisfaction of the health care professionals and additional caregivers, who reported that the platform was useful, close to their needs, easy to manage, and that they would be prepared to use a commercial version if available.

### Important Links:

Project website: <http://www.k4care.net>

Publication: Please, visit the K4CARE Wiki at <http://www.k4care.net/index.php?id=160>

eHealth FP6 Projects: [http://ec.europa.eu/information\\_society/activities/health/research/fp6projects](http://ec.europa.eu/information_society/activities/health/research/fp6projects)

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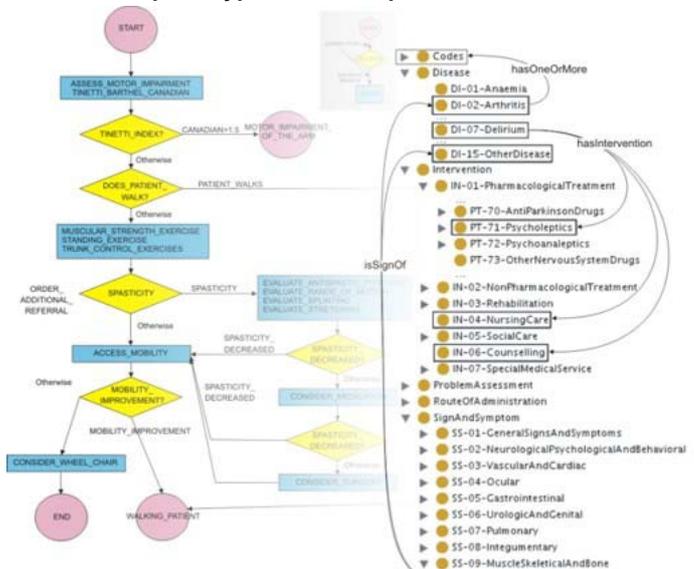
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## Summary of benefits

The K4CARE project involved the joint effort of 4 technological institutions and 7 health care centres. This consortium combined experiences of old and new EU countries to define a new health care model for care of elderly people. New knowledge-based ICT technologies were researched, developed and integrated in a final product that implements the health care model as a web platform. This is a validated prototype that optimises the safe



Knowledge Principles: Interrelated FIPs and Ontologies.

management of the care of chronically ill patients at home.

## Partners

Universitat Rovira i Virgili, Centro Assistenza Domiciliare RM B, Czech Technical University in Prague, Università degli Studi di Perugia, Telecom Italia, EURICE GmbH, Ana Aslan Int. Acad. of Aging, Fondazione Santa Lucia, MTA Szamitastechnikai es Automatizalasi Kutato Intezet, The Research Institute for the Care of Older People, Comune di Pollenza, General Univ. Hospital in Prague, and Szent Janos Hospital.

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