Knowledge-Based HomeCare eServices
for an Ageing Europe

Project Presentation
K4CARE Consortium

A Project funded by the European Community under the Sixth Framework Programme for Research and Technological Development
Project Fact Sheet

- Start date: 2006-03-01
- End date: 2009-02-28
- Duration: 36 months
- Project Reference: 026968
- EC funding: 3.130.000 €
- Type of project: Specific targeted research project
- Programme: 6th Framework Programme
- Thematic area: Information Society Technologies (IST)
- Coordinator: University of Rovira i Virgili, Tarragona, Spain.
- 13 Partners from 7 countries
Consortium

1. Rovira i Virgili University (URV) - Spain
2. Centro Assistenza Domiciliare Azienda Sanitaria Locale (CAD) – Italy
3. Czech Technical University Prague (CVUT) - Czech Republic
4. University of Perugia (UNIPG) - Italy
5. Telecom Italia (TI) – Italy
6. European Research and Project Office (Eurice) - Germany
7. Ana Aslan – International Academy of Ageing (ANA) - Romania
8. Fondazione Santa Lucia (FSL) - Italy
9. Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI) - Hungary
10. Szent Janos Hospital (SJH) - Hungary
11. The Research institute for the care of the elderly (RICE) - United Kingdom
12. Amministrazione Comunale di Pollenza (COMPOL) - Italy
13. General University Hospital Prague (GUH) - Czech Republic
K4Care Mission

K4CARE aims to create, implement, and validate a knowledge-based healthcare model for the professional assistance to senior patients at home.

This new Healthcare Model for home care will contribute to achieve a European standard supported by ICT technologies that improves the efficiency of the care services for all the citizens in the enlarged Europe.
General Objectives


2. K4CARE Platform: Propose a telematic and knowledge-based CS platform that implements the above model.

3. Validation: Conduct pilot tests in different EU countries in order to work-out their differences and to contribute to an approach for a homogeneous and unique European Healthcare ICT society in HC.

4. Usage & Projection: The K4CARE platform can serve as a means of integrating knowledge about HCPs assistance all over the new and old EU.
5. EHCR: The project will define a solution for Electronic Health-Care Record (EHCR) incorporating lessons learned in past experiences (e.g. I4C/TripleC and PROREC). This EHCR will integrate different data types and documents from different sources (e.g. hospital services, laboratories and relatives) taking into account international standards (HL7 and ENV13606) and international codification systems (ICD10 and ATC).

6. The EHCR will integrate information coming from different EU member countries (homogenising the differences) and will be under continuous evaluation and adaptation deriving from the specialised partners indications.
7. APO: Definition of the Actor Profile Ontology (APO) for representing the profiles of the subjects involved in the K4CARE model, i.e. healthcare professionals, patients and relatives, citizens, and social organisations.

8. CPO: Definition of the patient-Case Profile Ontology (CPO) for representing symptoms, diseases, syndromes, and case mix.

9. FIP: Definition of Formal Intervention Plans (FIP) describing the treatment of a number of diseases, symptoms, and syndromes.
10. Personalise the Access to the K4CARE platform: Adapt the APO to the user requirements in order to customise the access to the EHCR and the assistance provided by the K4CARE model.

11. Personalise the Assistance to senior citizens: CPO as they stand are not valid in real practice since a Home-Care Patient (HCP) has a combination of features which makes his/her treatment different from any other treatment.

12. FIPs will be inductively learned from the EHCR with the use of new Machine Learning algorithms. These must be developed and tested in the domain of HCPs.
13. K4CARE MAS: Design and implementation of intelligent agents (multi-agent system) that allow users to access the EHCR, edit, adapt, and merge ontologies; introduce and induce FIPs, and provide the HC services the K4CARE Model defines. Those services should be made available through ICT (Internet, mobile telephony, etc.) in a safe way, anytime and everywhere.

14. Development of an application that will be integrated in the K4CARE platform for localizing some patients topographically.
WP 1 – Define the K4Care Model: Structure

- The Model Structure:

  1 Nuclear Structure
  
  +
  
  \(n\) Accessory Services.
WP 1 – Define the K4Care Model: Actors and Teams

- Nuclear Structure:
WP 1 – Define the K4Care Model: Methodology

- Engineering Approach to develop the K4CARE Model:
  - **Analysis** of the Model: Define the functionality of the Model (K4CARE Services), the ICTs, and the intelligent services to make the system according to the requirements determined.
  - **General Design** of the Model: Enumerate the procedures to provide the above functionality.
  - **Detailed Design** of the Model: Describe these procedures as combination of actions provided by co-operating K4CARE actors.

- The interaction between the K4CARE consortium members will produce a healthcare model in which critical aspects are identified and solved in a cyclic process of evolving construction of the final K4CARE Model.

- **Deliverable D01**: The K4CARE Health-Care Model (Month 7)
WP 2 - Develop the EHCR: Antecedents

- Develop the K4CARE EHCR based upon:
  - The experiences of past EU projects (I4C/TripleC, PROREC)
  - International Standards: ENV13606 and HL7-CDA.

- It shall comply with the following requirements:
  - integrate data about patients, diseases, and health professionals (Data Base + EHCR)
  - be ready to seamlessly accept multilingual assertions
  - permit the exportation of portions of data to XML files

- This way the compatibility of the final platform with other products is complete in both senses: using other product results and allowing other products to use the K4C platform results.
WP 2 - Develop the EHCR: Design

- Data Base: with information about the K4CARE actors as users of the K4CARE Platform (e.g. contact information)
- EHCR: with the data about the Home-Care processes performed with the K4CARE Platform.
Once the K4C data model is developed, it will be used to host a sample of real data. This includes tens of health-care professionals, tens of diseases, and hundreds of patients.

The sample will be used as a test bench for testing the technologies developed in the project.

Once the EHCR was designed, it will be filled with the data of the new subjects that each healthcare partner will provide (at least 10±2 new subjects for each healthcare partner); in addition to the professional carers, one informal caregiver each new subject will be consulted in order to evaluate acceptance of the procedure and suggestions. Data from already existing archives will be provided for at least 50 (±10) subjects for each healthcare centre.

Those data, once vertically integrated (i.e. union of data), will serve for both testing the proper use of the platform and also acting as the input data (or training set) to the KD tools.
WP3 - Develop the K4CARE Ontologies: Definition

- **Actor Profile Ontology (APO)** structures the knowledge available in the K4CARE Model about the actors and work teams involved in Home-Care. The APO will contain the skills, expertise, knowledge, concerns, aspirations, etc. of the people they represent, together with the healthcare services those people offer to or receive from the K4C Model (deliverable D1).

- **Patient-Case Profile Ontology (CPO)** structures the knowledge available about the care of patients. The CPO will combine diseases, syndromes, signs and symptoms, social issues, assessment tests, and interventions in order to define a knowledge model of how to deal with Home-Care Patients.
WP3 - Develop the K4CARE Ontologies: Structure

- **APO**

  ![Diagram of APO ontology]

- **CPO**

  ![Diagram of CPO ontology]
WP3 - Develop the K4CARE Ontologies: Deliverables

D04 (month 11): The K4CARE APO v1.0.
D04 (month 20): The K4CARE APO v2.0.

D05 (month 11): The K4CARE CPO v1.0.
D05 (month 17): The K4CARE CPO v2.0.
D05 (month 20): The K4CARE CPO v3.0.
Formal Intervention Plans (FIPs) are formal structures representing the healthcare procedures to assist patients suffering from particular ailments or diseases.

FIPs are represented with the SDA* formalism:
- States
- Decisions
- Actions

The SDA* formalism will be used to represent:
- K4CARE Service Procedures (Deliverable D01)
- K4CARE Formal Intervention Plans (Deliverable D06)
- K4CARE Individual Intervention Plans
Some FIPs will represent the adaptation of clinical guidelines already published by international healthcare organizations as the National Library of Medicine and the National Guideline Clearinghouse in the USA, the New Zealand Guidelines Group, the Scottish SIGN, etc. to the context of the K4CARE project.

Some FIPs for those conditions and diseases in the project that do not have any trustable treatment published will be created within the K4CARE project. The integration of the experiences in the treatment of such cases by all the healthcare partners of the consortium will be the second way of developing FIPs.

Some FIPs will be (semi-)automatically induced from EHCR using novel intelligent data analysis techniques. Individual patient treatments throughout a long time period will provide evidence of how a general treatment of such sort of patients should be. New intelligent machine learning techniques will be implemented to make this evidence explicit under the SDA* formalism.
WP 4 - Develop K4CARE FIP: Deliverables

D06 (months 16): K4CARE FIPs v1.0
D06 (months 20): K4CARE FIPs v2.0
D06 (months 23): K4CARE FIPs v3.0
D06 (months 24): K4CARE FIPs v4.0
An APO must be instantiated in a particular physician, patient or citizen before it is applicable. This instantiation process will permit that a particular actor could introduce his or her particular vision of his role in the K4C model.

CPOs and FIPs respectively represent know-what and know-how knowledge about a disease and its treatment. However, this knowledge is rarely applicable as it is since the pathology of the patients use to be more complex due to the health particularities of the patient and also to the coexistence of several simultaneous conditions and diseases (co-morbidities) which affect one each other.

Developing intelligent mechanism to merge several single disease CPOs into one CPO representing a complex disease and several FIPs representing single treatments into one FIP describing a complex treatment are two important aspects to the service of the K4C platform users.
WP 5 - Implement Tools for Knowledge Tailoring: Deliverables

D07 (month 30): Knowledge Tailoring Tools, (they are prototypes)
WP 6 - Develop the K4CARE Platform

- Determine which are the basic Information and Communication Technologies that the users of the system should use to access the K4C platform
- Design and implement a multi-agent system that provides the services offered by the K4C platform (defined in WP01).
- Respect security requirements
- Integrate the multi-agent system into a web-accessible, secure and fail proof platform.

Deliverables
- D08 (month 16): The design of the Multi-Agent System
- D09 (month 20): Document stating the security requirements and how they are guaranteed in the multi-agent system
- D10 (month 25): Multi-agent system v1.0, (it is a prototype)
- D11 (month 29): Fail proof multi-agent system v2.0
WP 7 - Evaluate, Assess & Apply the K4C Platform

- Testing of the first release of the platform will be performed by each healthcare partner.

- Two main procedures will be followed:
  1. two healthcare partners, CAD RMB and ANA, will test the whole platform on 40 (±8) new subjects (HC patients); in addition to the professional carers, one informal caregiver for each new subject will be consulted in order to evaluate acceptance of the procedure and suggestions.
  2. healthcare partners with peculiar interest in special issues will test parts of the platform related to those topics:
     - UNIPG: cognitive disorders (assessment, treatment, transitional care)
     - HSANTALUCIA: rehabilitative (assessment, treatment, transitional care)
     - RICE: cognitive disorders (assessment, treatment, transitional care)
     - GUH: outpatients (information exchange hospital/HC; transitional care)
     - ST. JOHN'S: outpatients (information exchange hospital/HC; transitional care)
WP 7 - Evaluate, Assess & Apply the K4C Platform II

Testing of the first release of the platform will assess:

- the adherence to the homecare delivering procedures;
- the capability of collecting and integrating information from different sources;
  - the completeness and appropriateness of information collected (redundancy/lack of essentials);
  - the capability of sharing information;
  - the appropriateness and timing of presentation during the procedure of suggested guidelines;
  - the appropriateness and clinical pertinence of suggested FIPs;
  - the appropriateness of use during diagnostic, therapeutic, rehabilitative, supportive procedures;
  - the capability of managing the integration of and the adaptation to different approaches to homecare: physicians, nurses, physiotherapists, social assistants, social workers, informal carers, relatives;
- the overall friendliness of use;
- degree of satisfaction of the users involved.
WP 7 - Evaluate, Assess & Apply the K4C Platform III

- The assessment of the second release of the platform - final test - will be performed by COMPOL. It will be performed in the community of the town of Pollenza (Italy) and will involve the entire home care facility, GPs, the Municipality, Social Assistants, citizens representatives.

Deliverables
- D12 (month 28, 34): Validation and assessment of applicability of the K4CARE platform in the community
WP 8 – Dissemination: Outcomes

- Internal & external to the consortium disseminations.

- The outcomes to be disseminated include:
  - The K4CARE model.
  - The Electronic Healthcare Record (EHCR).
  - The first and second versions of the KM platform.
  - The learning and tailoring tools.
  - The knowledge produced and represented as ontologies.
Dissemination must be addressed to several communities:

- **Academic dissemination**: partners with educational competencies should lecture these results in their university subjects.
- **Institutional dissemination**: make the results be known by the heads of our units, the heads of the heads and so forth.
- **Technical dissemination**: papers in conferences, congresses, workshops, etc.
- **EU dissemination**: participate in EU sessions and conferences, contact heath-care and eHealth groups/committees in Brussels and also our national representatives, contact and notify our results to consortiums of other EU projects.
- **Political dissemination**: contacts with local and national governments.
- **Social dissemination**: papers, information notes to social organisations, etc.
WP 8 – Dissemination: Means

The means of external dissemination include:

- Public deliverables
- Project presentation, website, leaflets, etc.
- Publications in scientific-technological journals.
- Target groups identification & dissemination
- Contact scientific communities on KM in Medicine and Medicine, International organisations & universities
- Marketing (marketing study, take-up measures, etc.)
- Licensing
WP 8 – Dissemination: Deliverables

- D13 (month 6): Concise project presentation
- D14 (month 13, 25, 36): Releases of K4CARE platform
- D15 (month 13, 25, 36): Plan for using and disseminating knowledge
- D16 (month 36): Licenses for non-commercial usage of K4CARE
- D17 (month 36): Report on raising public participation and awareness
WP 9 - Project Management & Administration: Tasks

- The main general tasks that have to be scheduled concerning project management and administration are (and are co-ordinated by):
  - Decision Making Management (URV with the support of the MC)
  - S&T Co-ordination (URV with the support of the TC1 and the TC2)
  - Administrative Co-ordination (EURICE)
  - Financial Management (URV, EURICE)
  - Quality Management (EURICE)
WP 9 - Project Management & Administration: Deliverables

- D18. Exploitation Plan Agreement.
- D19 (month 1): Consortium agreement
- D20 (months 6, 12, 18, 24, 30): Management guide for project administration plus updates,
- D21 (months 6, 12, 28, 24, 30, 36): Project web site plus updates
- D22 (month 13, 25, 36): Activity and management reports,
Milestones: First Year

- **Semester 1**
  - M1.1 (month 3): determine the actors of the model and reach a consensus on their roles and liabilities within a model that integrates new and old EU country best procedures.

- **Semester 2**
  - M1.2 (month 7): mark out the functionality of the K4C model, imposing conditions on the sort of intelligent services to include and also the ICT technologies for approaching the model to the health professionals, the patients, and the citizens.
  - M3.1 (month 10): develop the actor profile ontologies.
  - M3.2 (month 10): propose a first version of a case profile ontology for post-stroke and diabetic patients.
Milestones: Second Year

Semester 3

- M4.1 (month 15) First versions of FIPs about treatments of post-stroke and diabetic patients.
- M3.3 (month 16): propose a first version of CPO with the remaining diseases.
- M5.1 (month 16): determine and develop the tools for instantiating APOs.
- M5.2 (month 18): first results on the construction of co-morbid pathologies.

Semester 4

- M3.4 (month 19): final version of the APO and CPO ontologies.
- M4.2 (month 19) First versions of FIPs about treatments of cognitive or mobility impaired patients.
- M2.1 (month 22): Decide about the data structures that are most appropriate to store data about patients, diseases, and healthcare professionals in the project domain.
- M4.3 (month 23) Last versions of all the ailment and disease handmade FIPs.
- M5.3 (month 23): revised and final versions of the algorithms to combine CPOs.
- M6.2 (month 23): First prototype of the K4C platform, to be evaluated and applied in WP07.
Milestones: Third Year

● Semester 5

- M5.4 (month 29): tools for personalizing FIPs
- M4.4 (month 34) FIPs obtained from automatic exploitation of the EHR.

● Semester 6

- M7.1. (month 34): K4CARE platform final tests.
Contact

If you have any questions do not hesitate to contact us!

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