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Homecare : The need for Cooperative Information Systems

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Abstract

Assuming responsibility of patients at home (Homecare) is organized around a complex co-operation of partners: health care actors, relatives and helpers, all of whom intervene in the patient's home and who spark off the setting up of co-operative information systems. We present our work relating to such systems within the context of home care. Such activity is based on the collaboration of multiple mobile actors, obtaining information in a multimodal fashion , while taking the job profiles and professional grades of the users into account. Information is obtained from heterogeneous systems. The quality of management of the activity of the various health care actors and of the feedback on information handled at the time of the homecare process will determine how easy it may be to set up homecare as well as the quality of care. In this paper we outline the main stages of our work: grasping the context of homecare and studying co-operative activity from a fundamental point of view but also as applied to homecare. We describe the system proposed for accessing distributed information and for organizing the supervision of the 2 fundamental processes: (1) the LOGISTICAL process (to manage the organization), (2) and the CARE Process (to follow-up the medical or nursing status of the patient) , and then we enhance the contribution of mobile technologies in this context.

Keywords

Telematics, Homecare, Telemedicine, Mobile Systems.

Introduction

With an ageing population and a growing demand for homecare for the elderly, many projects are currently being designed to help this population stay at home [1]. Numerous researches are focused on topics such as tele-surveillance, tele-monitoring and tele-assistance [2,3]. New captors, videos and robots are developed to make people live in their own accommodation, while improving their safety and security.

However, we observed that the requirements of the homecare workers (nurses, physicians, homecare organisations, even families) are more oriented towards the definition of services to improve the organisation and management of the homecare system, rather than the dissemination of tele-surveillance or tele-monitoring systems. The Homecare process involves (i) LOGISTICAL organisation and (ii) co-ordination of Healthcare workers invested in the process [4]. It is therefore needful to develop co-operative information systems to organise the chain and sequence of care, and allow for taking charge of the patient in the most efficient manner.

The development of such systems implies a precise analysis of the activities and cooperation processes of the various actors involved in homecare, a good knowledge and know-how of the different dimensions that need to be modelled, and the making of a prototype of such co-operative applications.

Background

Homecare

The term « Homecare » refers to a large variety of care modalities [4] including : Real "at home" hospitalisation , Nursing at home, Therapeutic accommodation, Nursing for elderly people , Psychiatric accommodation, post-hospitalisation nursing...

These modalities all share essential characteristics: they are delivered at home, in the patient's accommodation; they necessitate the coordination of a team of professionals assuming different functions; there is the necessity to organise a transfer of hospital competencies outside of the classical hospitalisation units, and to organise the network of the different actors of this new flexible and temporary therapeutic team.

Compared with hospital-based care, Homecare introduces new functions, new activities and new actors in the process of care: the family, the coordinator, the equipment provider. Moreover it illustrates the necessity for a clearly defined co-operative activity between the different people involved: they are not in a common place at the same moment; their co-operation is ASYNCHRONOUS and, by consequence, they have no direct communication, neither organised (e.g. the "round") nor spontaneous (coffee-break, ...). For this reason, Homecare necessitates an EXPLICIT Coordination Protocol.

Consequently, Homecare organisation implies the constitution of a network of different partners (Fig.1) , including the "deciders" (hospital, G.P, family) the "organisers" (for materials, beds, drugs, meals, human resources), those involved with the financial aspect of things (Social Security, Welfare organisations, Insurances), as well as the "carers" involved with giving the homecare itself (nursing, treatments, surveillance) or in the daily follow-up of the patient (family, nursing assistants).

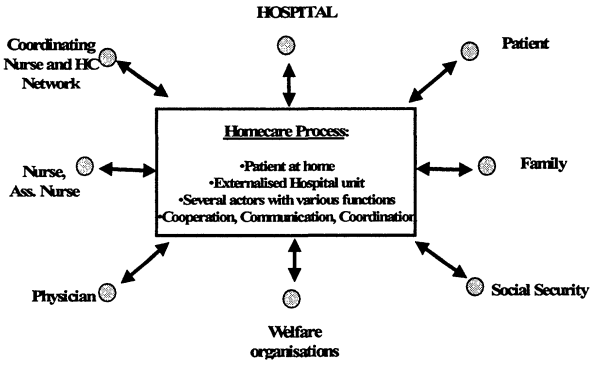

Figure 1 - Actors of the Homecare System

Analysis of the cooperative activities in Homecare

A complete analysis of the Homecare organisation was realised in order to define the type of tools that could be developed to support and improve the Homecare system for a large population of patients discharged early from hospitals, and above all, for a growing population of ageing and disabled patients [4].

This analysis proved that Homecare Organisation is built from two processes:

(i) the LOGISTICAL PROCESS: this process is managed and supervised by COORDINATORS, more often nurses. It includes the decision for and the organisation of Homecare. It can be broken down into several phases of ordering and programming tasks: (1) the **demand** for Homecare, which triggers an evaluation of the situation and results in the decision for or against homecare, (2) the **evaluation** of the requirements for material and human resources, (3) the **organisation** of the Care Process: preparation, by the coordinating nurse, of the Homecare Process (placing orders for materials, contacts with the different actors).

(ii) the CARE PROCESS: this process is under the responsibility of the medical and nursing team: they have to take charge of the therapeutic procedures and to cooperate for the realisation of various therapeutic activities.

These two processes are tightly interwoven, particularly in the first days of Homecare: the coordinator evaluates the needs and plans the resources, while the doctor, the nursing assistant, and the nurse initiate the care procedures. The diversity of competencies makes their interdependency more obvious.

n this framework, COOPERATION is indispensable and has to do with:

- the LOGISTICAL process between the coordinating nurse, the discharging hospital, the family, the welfare system, the material dispatcher
- the CARE process between the doctor, the nurse, the nursing assistant, the physiotherapist, the family and the patient
- the co-ordinating nurse mainly involved in the LOGISTICAL Process and the actors involved in the CARE process.

Given that these people do not meet together, communication is necessarily mediated through various media such as:

- Medical records, discharge letters, homecare demand, patient's files, orders and requirements (material, human resources).
- CARE book at the patient's home. This facilitates communication between the Healthcare professionals who intervene at home: doctors, nurses, aide-nurse, ...

In conclusion, Homecare implies an important COOPERATION between the different parties. This Cooperation is ASYNCHRONOUS, since meetings are exceptional, and is MEDIATED by different pieces of paper, dispersed in various locations (hospital, doctor's office, patient's home, coordinating nurse).

Our main objective is the definition and the realisation of a coordinating platform able to support the cooperative asynchronous activities of Homecare.

Description of the Technical Solution for supporting Cooperative Work In Homecare

As previously described, Homecare organisation can be divided into two sub-processes : "The LOGISTICAL Process", mainly managed by the coordinating nurse and The CARE Process mainly organised around the "Care book" available at the patient's home.

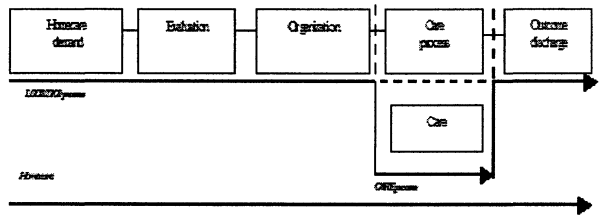

Figure 2 - The Homecare Process is made of 2 interwoven subprocess: the LOGISTICAL Process (demand, evaluation, organisation, Care, discharge) and the CARE Process itself

As a consequence, the architecture of the Computerised application needs to be organised on the same basis of two cooperative applications:

- One platform, mainly cooperative, for enabling and improving the coordination of the LOGISTICAL process
- One system enabling and improving the cooperation of the various actors involved in the CARE process. This system will have to take into account the mobility of the different cooperating partners (mobility of the nurse, of the family, of the doctor...).

Coordination platform

The homecare information system

This platform was designed to support the work of all the actors, but, primarily, of the coordinator. It takes into account the different pieces of information necessary for the initialisation, the organisation and the discharge of a patient within the Homecare

process: it is an Information System dedicated to the management of Homecare. Call it "Homecare Information System" (HomeCare IS). This Homecare IS is organised into 5 subsystems, managing the 5 sub-phases of the LOGISTICAL subprocess: Demand, Evaluation, Organisation, CARE Process, Discharge.

This Coordination Platform is organised around the following concepts:

- Interconnection of the different Information Systems (HIS, GP Medical Records, Patient's record, ...)
- Visualisation of the current process, of the available info, of the latest updates
- Security of exchanges

The architecture of the Homecare Information System is relatively simple and can be organised as a DataBase grouping and organising the patients files.

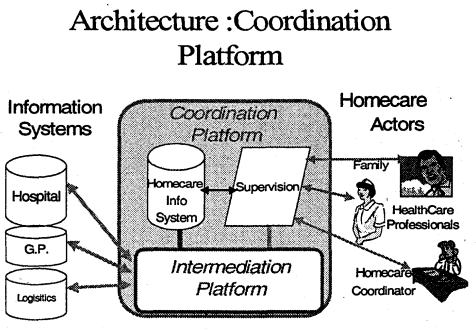

Figure 3 - The Coordination Platform is made of 2 parts : (1) a Homecare Information System gathering and organising information coming from various external sources and (2) a Supervision Interface to give access to this information by the coordinator and other Homecare Actors (Family, HC Professionals). This supervision system is also reachable through mobile systems

Supervision interface

This Homecare Information System is principally built to help the coordinating nurse to gather relevant data for the Homecare LOGISTICAL process. It has also to be consulted by the other actors: family, physician, nurse, nursing assistant... to evaluate their workload and to know when and where, for which patient to intervene. So the Homecare Information System has to be accessible through secure Internet by these HC professionals for consultation, and for completing necessary information (availability, necessary materials, special requirements, completion of the record). This access is managed through a special interface, shared by the different actors and **called "Supervision Interface"**.

This supervision system has to:

- propose a common and shared representation of the process, and the evolution of the Homecare phases.
- describe the different phases recursively, going from sub-phases to sub-sub-phases of a given process.
- complete the information relevant to managing the Homecare process.
- use the "Intermediation Platform" [5] used to managed the communication of Healthcare Actors in a region.

Cartesen et Schmidt [6] underline the complexity of the design of cooperative applications and they propose to distinguish two complementary aspects : (1) the management of the inter-dependencies between the tasks, and (2) the management of the Information space designed to improve the communication between the various actors.

Our Architecture is based on these two principles : (1) a Homecare Information System for the management of tasks and (2) a supervision Interface for the management of the common Information space.

Mobile systems

Mobile systems are today completely embedded in Information Systems. They are part of a new "mobile civilisation" where:

- Information concerning new treatments or treatment updates, are indicated as soon as possible to the coordination nurse and to the other actors of the network to organise the chain of activities necessary to apply this decision.
- The various HC professionals can be contacted at any moment to receive the latest information of interest (appointment, treatment effect, evolution of patient status).
- All the data concerning a specific patient must be readable by everyone ; this information could be in the Homecare Information System or on mobile systems.
- Every HC actor can contribute to the quality of data, concerning the patient's HC problem, but also concurrent problems concerning welfare, family, etc.

The Care book at patient's home

Currently, there is a paper booklet at the patient's home summarising all the information concerning the patient, his(her) therapy, the list of drugs, but moreover all the transmissions between the HC actors involved in the Homecare Process.

The nursing assistant, the nurse, the physician, but also the patient him(her)self records relevant data in this local booklet so that this information can be read and accessed by the others. For all the HC workers, this booklet is indispensable for recording the evolution of the patient, of the treatments, and of continuous updates.

This care booklet can be replaced by a microcomputer or a PDA connected through internet to make available different functions such as:

- The agenda of the patient and of the Homecare Actors,
- The updated medical and nurse record,
- The transmission of information between the family and the HC workers, and within the circle of the HC workers.

This care book is connectable through Internet with the Homecare Information System, allowing a regular and continuous update of the patient's data.

Building a prototype

The main technical characteristics of the prototype are summarised in table 1.

Table 1: .

Technical Solutions :
Communication : Intermediation Platform RITHME™ [5]:
Healthcare professionals' Directory
Patients' Directory
Security Management
Notification (Emergency, breakdowns, technical problems)
Data Formatting
Homecare information System : Relational DataBase
Supervision Interface : Workflow system [7, 8]
JAVA Applets and servlets
Web client
Data repository
Mobile Systems
Personal Digital Assistant
Cellular Phone : GSM, GPRS (+), UMTS

The ***Supervision Interface*** allows to follow and manage the 5 sub-processes of the ***Homecare Information System.***

1. DEMAND form is fulfilled by the discharging hospital, or the requiring GP, and completed by the coordinating nurse and/or the family doctor.
2. EVALUATION form is fulfilled by the coordinating nurse with the help of family, relatives and the homecare nurse
3. ORGANISATION is under the control of the coordinating nurse
4. CARE is followed mainly by the Nurse, the family doctor and the Coordinating Nurse
5. DISCHARGE is organised by the Coordinating Nurse in agreement with the GP and the family.

Each of these 5 sub-processes can be divided in sub-sub-process and refined until all the necessary information are gathered for an optimal management of the Homecare process. For each step, special forms can be implemented to be fulfilled by the concerned Healthcare Professionals. These forms can be consulted through Internet, and, if necessary modified, at distance.

To allow this distant access to the Coordination Platform, we propose to use **mobile systems** such as cell phones or PDA (Personal Digital Assistant) [9]. These systems can be connected to various networks: GSM, GPRS and the future UMTS. All the Healthcare actors are given a mobile system to be connected through various techniques: text (SMS), voice (VOICEXML), WAP and IMOD... These mobile systems make the sharing of data easier between the various actors of the Homecare Organisation. The synchronisation of the PDA with the central Homecare IS through the Supervision Module will give a complete view of the current status of the process.

The patient's «Care book », currently existing under a paper form at the patient's home, is replaced by a PDA (Ipaq or PalmPilot). Each HC Professional intervening in the patient's home can consult, read, modify or update these data in agreement with the evolution of patient's status. The following figure summarises the architecture of the prototype.

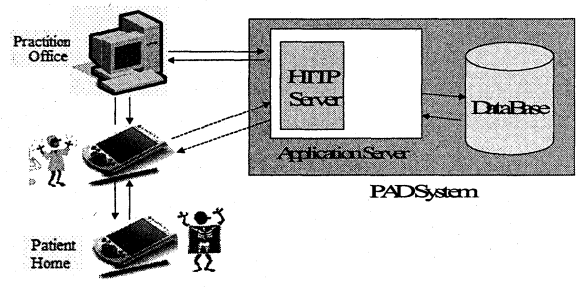

Figure 4 - Prototype for Homecare (PAD) including mobile systems

Conclusion

Homecare necessitates a complex cooperative environment that has to be precisely studied. We have the purpose of developing a cooperative information system dedicated to meet the needs and requirements of the various actors involved in the Homecare Process. We underline the existence of different activity phases (LOGISTICAL Process and CARE Process) with different objectives, different actors and different requirements: Access to distributed data and communication of information during the LOGISTICAL Phase, communication and support for cooperative work during the CARE Process. Three orientations for the development of computer applications are then obvious: (1) Interconnection of existing information systems, in a secure an safe network, to aggregate and distribute the necessary information for the organisation and management of the Homecare Process: this is the Homecare Information System; (2)Supervision of the process using a workflow system allowing a collective activity; (3) Mobile systems to take into account the mobility of the actors, including an electronic Care book at the patient's home that could concentrate all the relevant info necessary for transmissions between the actors of the CARE Process.

This system has been prototyped and in currently under experimentation. The Homecare Information System and the Supervision Interface have been well accepted for the LOGISTICAL Process. A complete evaluation of the system is currently organised. With the growing demand for maintaining at home ageing people, and a better follow-up of patients and dependant population, this application can be a solution for optimising the collaboration of those who take charge of these people.

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