The European Union, with a funding for research activities within the Health Care for Citizens programme, gave birth to the HOMEY project in year 2001. The project goal is of building dialogue systems, which will make the communication, between specialist health centres and patients with chronic diseases, easier and more efficient.

One of Homey partners, the Consorzio di Bioingegneria e Informatica Medica, based in Pavia, Italy, made an innovative contribution by creating a prototypical dialogue-based telemedicine system for hypertensive patients. The system was developed in collaboration with specialists in hypertension care from various Italian hospitals.

A dialog system is a complex software installed in a particular computer workstation, called “telephony platform”, connected to a toll-free telephone number. When a call comes in, the computer is able to answer and talk to the caller through a natural dialog and a synthesised voice. The machine is also able to comprehend the user’s answers, provided in natural language. In this way a conversation takes place on the telephone line between computer and patient. The automatic dialogue, besides the limitation due to the fact that on one side there’s “merely” a machine rather than a human, can nevertheless serve and autonomously solve simple and repeating tasks, such as provide train table information, book laboratory tests, or – as in the case of Homey – collect clinical information from patients, directly from their home, or wherever a phone can be employed (including mobile phones).

Hypertension is a chronic disease whose care requires attention and care regarding monitoring of blood pressure values, weight and heart rate. Numerous clinical tests, in fact, proved that long-term elevated blood pressure values remarkably increase the probability of serious damage of important body organs. Hypertension affects a large fraction of European adult population: according to recent estimates, as high as 40%. Luckily, drugs available to reduce blood pressure are numerous and effective.

Specialist centres have an outstanding role in the care process of the disease. In these centres, physicians are able to apply the latest best-practice care procedures (according to internationally accepted guidelines), adapting them to the specific patient. An effective care, however, requires that doctors are timely informed of the health status of their patients: for example, they should know the blood pressure values, whether side effects occurred, and also whether patients were compliant with the prescribed therapy. Therapy, in fact, often comprises of both, drugs and life style modifications, such as doing more physical exercise and ceasing to smoke.

Higher quality of interaction between physician and patient, and the information exchange between the two, are therefore essential for the effective care of hypertension and other chronic diseases. The dialogue system which Homey partners are developing serves this purpose: to enable doctors and patients to continuously exchange information on health conditions – and to have this information flow happening in a simple and timely way, even during the time between their physical encounters.
Simplicity is assured by the use of the telephone, which is an easily available resource. The use of a dialogue system replaces the need of using specialized computer-based tools, sometimes complicated, and at the same time grants that the precious information collected is organized and stored, and not lost, for example, in loose notes. Thanks to the use of a common telephone, information is immediately transferred to the care centre, where doctors are able to evaluate it and decide, when necessary, suitable changes to make the therapy effective. To be useful, a data collection system must also organize the data acquired and present it in order to be easily interpreted, and therefore support the physician’s decision process.

This simplicity hides the adoption of innovative technologies, gathered from research both on human speech recognition (ASR), and automatic creation of natural language dialogues. In the Homey systems the technologies are integrated with an electronic health record system, able to store demographic data, disease history, outcomes of previous visits and laboratory tests, and – above all – blood pressure values and side effects possibly observed. Such data is recorded and stored, for each patient, both whether it comes from the physician’s visit, or self-reported by the patient on the telephone via the dialogue system.

Such features, however, are not all of the functions of the dialogue system: technology innovation in this telemedicine project led us to realize a system that generates a dialogue tailored to every single patient. Data stored in the clinical records, together with the history of calls made by a patient, are accounted for, by the system. It is able to formulate, a different dialogue on a case-by-case basis and, for which, it depends on the specific condition of the patient, prescribed drugs, and his or her life style. The dialogue, however automatic, is therefore adaptive: its internal workings take into account both the information contained in the clinical records, and the medical knowledge coded in the guidelines.

The sophistication of this system, naturally, is going to be useful only if its features are also within the reach of inexperienced users. When they need to, both, physicians and patients can connect to the system simply through their plain web browser. Doctors will therefore be able to review data entered by patients, laboratories, and so on. Patients will have at hand another modality (i.e. the common mouse and keyboard), should they prefer interacting through the Internet rather than via voice and telephone.

Currently the system is undergoing a controlled clinical trial, a sophisticated validation to assess, with very rigorous criteria, whether the system is able to improve the health conditions and communication between doctor and patients. The trial is being carried out with a collaboration between volunteer physicians and patients from different Italian hospitals. The forthcoming statistical analysis of test outcomes will allow us to further comprehend in depth the implications and cost-effectiveness issues of advanced vocal telemedicine systems like the one developed by the Homey Consortium.

**Partners of the “Homey” project**

The Homey project is carried out with a partnership of five major European institutions, both from the academic and commercial world: Engineering Group based in Rome (coordinator), Consorzio di Bioingegneria ed Informatica Medica (I), Reitek SpA of Milan (I), Istituto Trentino di Cultura (I), Imperial Cancer Research UK and Language and Computing (B). The Consorzio di Bioingegneria e Informatica Medica is a society connected with the Medical Informatics Laboratory of the University of Pavia, which realizes several academic research prototypes. The Homey hypertension prototype is currently under evaluation in the Careggi (Florence), Sacco (Milan) and San Matteo (Pavia) Hospitals.