

INNOVATION REPORT

Tackling healthcare dilemmas in an ageing population



Casper Garos, Philips Healthcare

With average survival rates and age of the Western population continuing to rise, healthcare services are coming under increasing pressure as the number of chronic diseases requiring long-term treatment grows. The resulting costs and shortage of personnel present real challenges and healthcare innovation is being pushed to the limit to come up with clinical and technological solutions to collate medical data and knowledge from different sources and domains in order to address the continuum of care of all of those medical conditions.

The ITEA 2 project Care4Me set out to improve quality and productivity in healthcare using advanced medical imaging and decision-support methods combined with different knowledge sources, from early diagnosis to treatment and monitoring. With the ultimate goal of developing clinical prototypes for early diagnosis of cancer, cardiovascular and neurodegenerative diseases connected to hospital information systems in a new systems architecture, this project represents the first stage of a roadmap for future medical imaging systems, like X-ray and Magnetic Resonance (MR) imaging systems.

A comprehensive approach to diagnosis and treatment

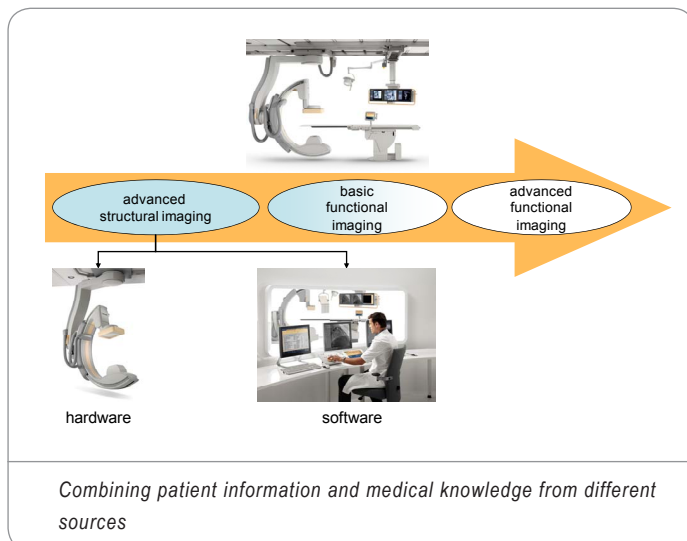
The Care4Me consortium combined strengths from different countries, involving large and small medical equipment

industry, research institutes that are specialised in service oriented IT systems design, implementation and deployment as well as in medical research. Finally, the consortium included academic hospitals that have experience and expertise in deploying innovative technology to the benefit of their patients and society. By focusing on improved early diagnosis in three specific and diverse medical domains – oncology, or cancer diagnosis, cardiovascular diseases and neuro-degenerative diseases – this allowed for plenty of cross fertilisation in the techniques that could be developed.

The combination of information and knowledge from multiple sources enables better decisions to be made. One particular success concerns assessing the risk of coronary artery disease. While you can see the occlusion on the artery wall, for example, perfectly well with existing X-ray techniques, intravascular ultrasound is a technique that allows you to determine in much more detail the state of the artery wall and the risk of it tearing in the event of an intervention or whether it is stable enough to allow an intervention. The addition of an extra measure might seem, in the short term, to make the intervention more expensive but if the right assessment can be made immediately following the intervention and whether the intervention has succeeded or not, costs are saved in the long term. In essence, the long-term health benefits of multiple modalities to make the right decisions now outweigh the costs of using more than a single modality. The comprehensive approach is geared to optimising the entire episode of care and not being limited to the current medical encounter. The same applies to oncology. You can see the cancer through imaging but integrating other information such as smoking history, pathology information and patient lifestyle can help target the right, personalised treatment and save costs later on.

Prevention for better care

This combination of personalised treatment and early recognition means that preventive measures can be taken and this can have a real impact not only on the costs but also and importantly on the patient. Prevention was also one of the successes of the ITEA 2 Care4Me project and was evident in cardiovascular diseases in which the use of mobile devices to



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record data such as blood pressure, weight, exercise patterns and how people feel enabled trends to be extrapolated and feedback to be given – continue exercising in the same way, modify diet, take time out – as a kind of lifestyle coach. Pilots in Finland on such out-of-hospital activity at the interface of lifestyle and healthcare really showed how this coaching helped to significantly reduce blood pressure, which will eventually lead to preventing cardiac problems.

The development of advanced medical image analysis and combining this with more functional and quantitative information enables physicians and clinicians to make earlier and more precise diagnoses. The key technical innovation in Care4Me lies in developing new medical image-processing software capable of extracting relevant image information from very large data sets and combining this with other types of medical data and knowledge.

Exploiting the results

The key results of the Care4Me project can be summarised as an open and dynamic hospital-wide, service-oriented architecture that integrates models of anatomy and pathology, computer-aided detection and diagnosis components as well as decision-support tools. In addition, models of healthy and diseased organs and tissues provide the knowledge needed to create a new generation of computer-aided detection and diagnosis processes. The image-analysis packages that were developed enhance computer aided detection, quantification and diagnosis of disease progression over time. Finally, computerised decision-support systems provide the clinician with a consistent overview of all information relevant to individual therapeutic options or assessments and risk evaluations, taking into consideration the different medical procedures in the diagnosis and treatment of cancer, and cardiovascular and neurodegenerative diseases.

The large number of image processing tools, models and algorithms developed during the course of the Care4Me project along with the generic MIS architecture with an extension to cloud computing were significant achievements as were the tools developed by the Finnish consortium partners for the prevention of disease and decision support for patients. The results for oncology, more specifically prostate cancer, and the use of High Performance Computing technology for image processing were manifested in two demonstrators. The prostate cancer therapy demonstrator introduced automatic prostate segmentation, which reduced the time in treatment preparation per patient from half an hour to just a few minutes while the HPC demonstrator incorporated two pilots on image processing on Bull High Performance computers whereby the time needed for data processing results was reduced.

There is clearly considerable exploitation potential for cardiology tools and products and fast exploitation of the results was achieved for a number of software packages, including QCA-3d by Pie Medical, Qivius by Medis and ClarityIQ by Philips Healthcare, the latter involving image processing, digital imaging pipeline and 500 clinically fine-tuned parameters. This level of exploitation is very high and the potential impact can be huge.

European and worldwide impact

Global economic growth, dramatic changes in demographics and the development of new medical diagnostic and interventional technologies have drastically altered the prevalence of diseases affecting mankind. The emergence of molecular healthcare and clinical information technology (IT) solutions such as those delivered by Care4Me will help solve the problems of a healthcare system under increasing strain.

This ITEA 2 project fits within the long-term vision of a transition from structural to functional imaging in healthcare through three consecutive steps: advanced structural imaging, basic functional imaging and advanced functional imaging. Functional imaging not only detects the anatomy or structure of the body but also the condition at tissue level of organs within the body. To establish this transition, new detector electronics and new imaging software are required. By focusing on this first step in the innovative process – advanced structural imaging – and making a start on the second stage of innovation in terms of basic functional imaging, Care4Me has managed to deliver a new generation of medical imaging analysis software that provides more accurate, functional and quantitative information from the acquired images and combine this with clinical information and knowledge obtained from other sources.

The upshot of all this will be better patient care – particularly with regard to the ageing population – and lower healthcare costs. Through the approach, scale and composition of its consortium, Care4Me has helped to strengthen the competitive position of Europe, especially for its consortium partners, and will have an impact on worldwide marketing and employment opportunities.

More information:

www.compassis.com/care4me/en/Care4Me