Home-based rehabilitation for CVD patients

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Patients who are found to suffer from cardiovascular diseases often have long years of treatment ahead of them and are urged to drastically change their lifestyle. But what is probably the most difficult part of the process is the return home where old habits die hard. A new technology relying on remote sensors could soon make post-CVD-event life a whole lot easier.

'Cardiovascular disease' (CVD) is a real plague for society. Not only is patient rehabilitation difficult, but the financial burden is enormous. According to WHO estimates, CVD costs the EU some EUR 196 billion each year. And despite public investment, it still causes as much as 46 times the number of deaths and 11 times the disease burden caused by AIDS, tuberculosis and malaria combined. Four million patients die of

CVD each year in Europe.

In order to live longer and eventually reduce the health and financial burden CVD represents for society, patients are required to quit smoking, eat more fruit and vegetables and increase physical activity, all this while being subjected to combination drug therapy and having their blood pressure monitored on a regular basis. Whilst this is all manageable in the hospital, it is much more difficult at home where exercise-based cardiac rehabilitation continues to be underutilised.

The HEARTWAYS (Advanced solutions for supporting cardiac patients in rehabilitation) project was born from the idea that implementing quality performance measures, automated referral systems, and the option of exercise-based cardiac rehabilitation at home for some patients may all help to reduce the risk of suffering an acute cardiac event again. The project, which is due to end in September, is developing advanced wearable sensors and intelligent algorithms for supporting cardiac patients in rehabilitation outside medical centres.

Juan Pablo LÃ¡zaro-Ramos, R&D director at TSB in Spain and coordinator of the project, explains how the new technology will help to monitor the vital signs needed for diagnosis, assess exercise performance and progress, and enable remote personalised support as part of monitoring more patients without reducing the quality of care.

What are the main objectives of the project?

Juan Pablo LÃ¡zaro-Ramos: HEARTWAYS aims to develop an advanced, remote modular IT solution for patients suffering from cardiovascular disease as they begin a rehabilitation process outside medical centres - at home for example.

The technology is comprised of: t-shirts embedded with wearable

sensors to monitor breathing rates and heart rates; ECG and pulsioximetry measurements; accelerometers placed in patients' arms and legs to measure exercise performance; and intelligent algorithms. We gather data on exercise, lifestyle, the patient profile and clinical history, and translate this into a risk assessment of future health events.

The technology is of course targeting professionals - helping them with patient follow-up, intervention strategies and clinical care plans, but it doesn't stop there. Patients will also have access to their personal data by means of a mobile app, so that they can adapt their lifestyle and control the effectiveness of physical exercise, wherever they are.

What is new or innovative about the technology you are developing?

The HEARTWAYS technology is the first cardiovascular monitor predicting risk based on personalised data. The innovation resides both in individual technologies and in the overall system. Bringing all stakeholders and solutions together around a single system for use by both patients and professionals is an innovation per se.

The special gloves integrating pulsiometry and other sensors, and the creation of intelligent multiparametric analysis middleware integrating information coming from various sources into a single communication framework, are also major innovations. The system leaves the door open to additional information systems and sensors, making future integration with existing customer IT systems an easy task.

Generally speaking, HEARTWAYS will allow doctors following up CVD patients to prescribe technology for the mid and long-term rehabilitation process, which they couldn't do until today.

How will it improve patients' lives?

Our technology is efficient, safe and cost-effective. It brings CVD patients closer to their families, allows them to blend back into society, and reduces stress associated with management of the disease as well as the need for psychological support.

The related reduction in hospitalisations and acute events also enables significant cost savings to be made.

What were the main difficulties you faced and how did you resolve them?

We faced four main challenges, each related to one of the technologies we developed.

The first challenge was the development of algorithms capable of performing personalised risk assessments in terms of the risk of new acute heart events in the short-term. Then, we had to find a way to produce usable and affordable sensors, knowing this has, until now, been one of the main drawbacks of such technology.

Making our mobile app accessible by all patients, intuitive and integrated into everyday patient processes, was also a challenge.

Last but not least, we had to position our technology in a market traditionally reluctant to take up technology prescriptions because of the lack of evidence. HEARTWAYS will gather its own evidence by means of a clinical study that will measure both economic savings and improvements in the clinical condition of patients using it.

What are the next steps for the project itself and after

it ends?

We will soon start clinical trials with 30 users in two hospitals in Valencia (Spain) in order to validate the clinical protocols behind the assistance process.

We need to validate the overall composite in different countries (Croatia, Italy and Portugal) regarding usability, acceptability and expectations from an end user point of view and from the market point of view. Then, we need to provide a product exploitation plan in both public (public health systems) and private markets (rehabilitation clinics and centres, private insurance-based healthcare providers).

When do you expect the technology to be made available for patients?

The clinical trials start in July 2014 and last until April 2015. If indicators on economic savings and improvements in terms of risk and cases of relapses are positive, trials will continue in hospitals already using the technology and should be available to customers and patients by the end of 2015 or early 2016, especially in the public sector. Market prospection started this year, and it is possible that early bird private customers may start using the system in the last quarter of the year, once the medical device certification process is complete.

If successful, what could HEARTWAYS mean in terms in economic benefits for society?

Exercise-based cardiac rehabilitation has proven to be beneficial for patients. It can lead to a 25?% reduction in mortality from cardiovascular disease over three years, improve psychological factors and quality of life, create incentives for a healthy lifestyle and reduce the

probability of future cardiac events and hospital readmissions.

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