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eHealth Monthly Focus

HeartCycle

Compliance and Effectiveness in HF and CAD closed-loop Management

European Commission Information Society and Media

HeartCycle is an Integrated Project aiming at researching, developing and clinically validating innovative solutions for the management of cardiovascular diseases. We focus on patients after heart attack and chronically ill heart failure patients. In future the number of these patients will dramatically increase due to the demographic change. We will face a large need for care and at the same time a gap in the number of available care givers. Finding better ways that allow health professionals to manage and treat more patients with high-quality healthcare at moderate cost is therefore seen as a huge opportunity space. Empowering patients to play a more active role in their own disease management will be crucial but remains a major challenge.

The **HeartCycle** project develops technologies and services for Telehealth, which is to **remotely monitor and manage patients at home** and motivate them to be compliant to treatment regimes and to a **beneficial lifestyle**. Telehealth allows a shift from episodically care to continuous care (fig.1) due to the more **frequent (daily) follow-up on the patients' health status**. This allows healthcare professionals to better control the progress of the therapy, detect upcoming adverse events early and react in time with **personalised care plan adjustments**, leading to stabilisation of the patient and **avoidance of costly hospitalisations**.

Application oriented approach

HeartCycle started in 2008 with an application oriented approach. In the first year we have investigated, analysed, and validated the **needs of patients and professionals for specific Telehealth disease management solutions**. Five university hospitals with experience in Telehealth are members of the HeartCycle Consortium (see HeartCycle factsheet). We have an **experienced and strong medical team with leading experts in cardiology and nurse education** and Prof. Cleland as HeartCycle Chief Medical Officer.

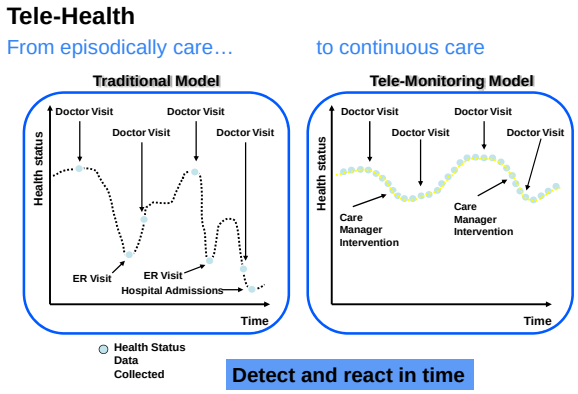

Figure 1: Telehealth enables to follow patient health status and therapy progress on a daily base allowing control and adjustment of patient care plans if needed and early detection of upcoming events resulting in a more stabilised patient status.

In interviews and workshops, we identified needs for future telehealth systems e.g. more efficient workflow for professionals, decision support technology, personalisation of patient care plans, support to use guideline-based therapy and optimal use of medication. Based on these needs, we researched and developed specific HeartCycle concepts (use cases). These concepts are applications that are tailored to a specific patient group. Finally we focus on three concepts in HeartCycle:

- Guided Exercises for coronary artery disease (CAD) patients e.g. patients after heart attack giving support for **cardio-rehabilitation** using a wearable heart rate and respiration monitor and a closed-loop system for tailoring the exercise plan and providing feedback during the exercise.
- Disease management for heart failure (HF) patients including **prevention of hospitalisation** through early detection and intervention to keep the patient in a stable condition, and medication management for chronic patients.

- Assessment procedures for both patients groups including innovative sensor measurements, **personalised healthcare processes** and risk stratification strategies.

Technical approach

The **HeartCycle** systems consist of two loops (see HeartCycle factsheet). An inner home-based loop directly interacts with the patients in their daily lives, giving feedback, motivation and help, and an outer loop involves medical professionals, maintaining a personalised care plan for optimal therapy. The **HeartCycle systems comprise innovative sensors for home use by patients**, e.g. unobtrusive and easy-to-use wearable sensor technologies and devices for communication and information exchange, e.g. smart phones or TV via set top boxes. The collected information on the health status is sent to medical backend systems where sophisticated algorithms are analysing the patient data to detect alarms or alerts. This will be achieved by multi-parametric monitoring and analysis of vital signs and other measurements such as lab results and symptom questionnaires. Furthermore, decision support algorithms will provide recommendations in case of alarms and alerts.

Achievements until year 3

Three HeartCycle systems have been specified and are in the final implementation phase ready for the clinical validations. All innovative sensor devices, the algorithms for alarm detection and the decision support algorithms have been developed and tested in time. Figure 2 shows the Guided Exercise system as an example. The IMAGE sensor is a wearable unobtrusive system consisting of two electrodes, for ECG (heart rate extraction), respiration (breathing rate extraction) and acceleration (posture and activity extraction). It includes embedded signal processing and feature extraction software and is a major component of the Guided Exercise system (GEx) for guiding patients during the cardiac rehabilitation process. The sensor communicates wirelessly with a Smart phone over Bluetooth. Professionals as well as patients receive the tailored information via the two loops.

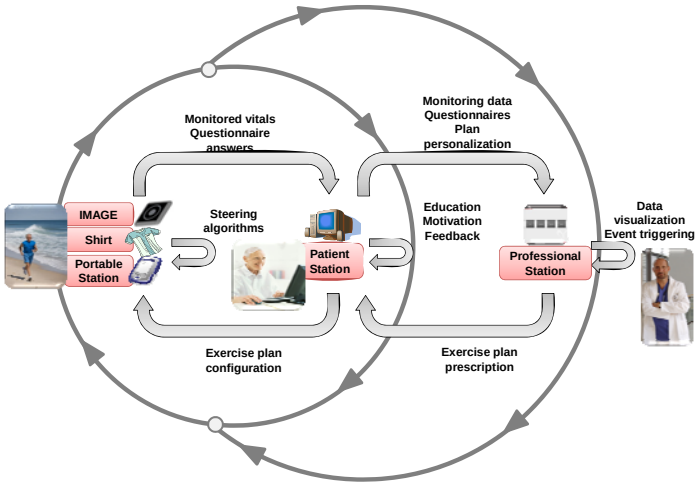

Fig.2 The Guided Exercise System, providing closed-loop management approach.

Impact: Clinical Validation for medical endorsement

HeartCycle is developing, implementing and validating these concepts to a maturity level that allows operation in clinical studies. Important aspects are testing the technical feasibility, the user acceptance of patients and that the concepts present new ways to deliver improved healthcare to patients and optimise workflow for professionals.

Clinical validation is a prerequisite to convince stakeholders to implement the Heartcycle innovations in healthcare. In May 2011 we will start two interventional clinical studies, each running for 12 months. The Guided Exercises trial includes three clinical sites (Aachen, Madrid, Hull) and 120 patients. The heart failure trial includes three clinical sites (Hull, Heidelberg, Barcelona) and 140 patients. It is of upmost importance that the HeartCycle solutions deliver reliable measurement results and health status assessments where medical professionals can base decisions on. This is a prerequisite for closing the loop and enabling efficient healthcare and cost effective disease management. Furthermore strategies to motivate patients to be compliant will be tested against control groups.

Timetable:	from 03/2008 – to 02/2012
Total cost:	€ 21.995.000
EC funding:	€ 14.100.000
Instrument:	IP
Project Identifier:	FP7- ICT- 216695

Important Links:

Project website: www.heartcycle.eu
Project factsheet: http://ec.europa.eu/information_society/activities/health/docs/projects/fp7/heartcycle-factsheet.pdf
ICT for Health website: http://ec.europa.eu/information_society/ehealth

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