

HEARTMAN

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Personal Decision Support System for Heart Failure Management

MONITORING PHYSICAL AND PSYCHOLOGICAL STATE

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Introduction



The goal of the HeartMan project is to help patients with congestive heart failure (CHF) better manage their disease. In CHF, the heart cannot pump enough blood to properly supply the body with oxygen and nutrients, resulting in an inability to be physically active and other symptoms. In most developed countries, one senior out of every 15 on average suffers from CHF. Moreover, CHF is the most common reason why seniors have to visit the hospital, and it cannot be cured.



The HeartMan project is developing a personal health system consisting of a mobile application, sensing wristband, and a backend in the cloud where patient data is managed in a secure and standard-compliant way. The application will provide personalised advice on exercise, healthy diet, medications, weight monitoring, and other aspects of lifestyle and treatment. It will also offer psychological support through a cognitive behavioural therapy and mindfulness exercises.



Studying literature concerning heart failure on HeartMan

The HeartMan system will provide personalized lifestyle advice to heart failure patients. This lifestyle advice is based on the current international guidelines on heart failure treatment provided by experts and also on the existing scientific knowledge concerning

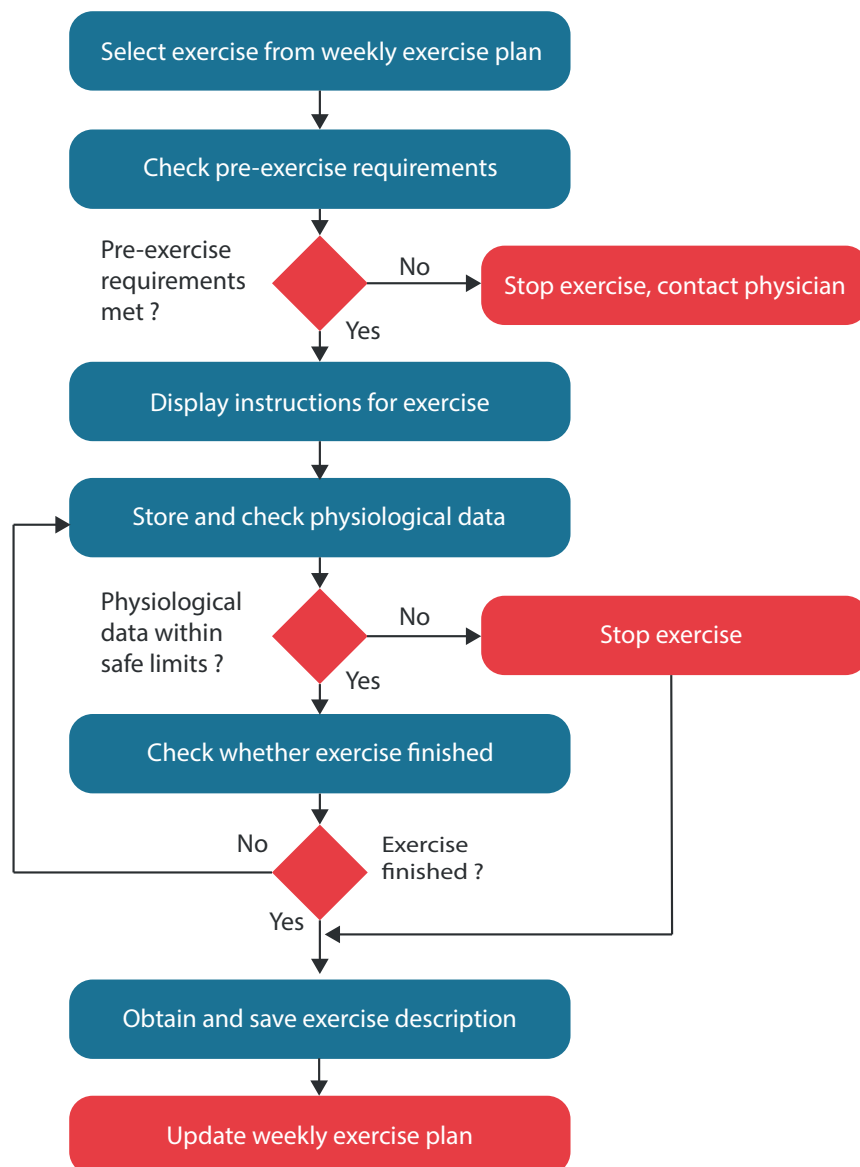
influencing factors on mortality and quality of life in heart failure. Therefore, one of the first steps in this project was to screen the available literature on this topic, with next picture giving an idea about the amount of work:



The Decision Support System (DSS)

Based on the collected literature, we are currently developing a decision support system (DSS) for the patient, which will be accessed through the mobile application. We have so far developed support for exercise and nutrition. The DSS prepares an exercise plan each week, which depends on the patient's physical condition, preferences and physician's input. On exercise days, the patients' heart rate and blood pressure are checked to determine if it is safe for them to start exercising. Afterwards, they are provided with instructions and are monitored via the sensing wristband. The flow of the daily exercise execution is shown in the picture in more detail.

The nutrition support consists of a series of questions that test the patients' knowledge of appropriate nutrition and educate them as needed. Another series of questions is used periodically to assess their diet. Both series are used to determine which are the more difficult topics for the patients. Additional educational and motivational messages are then provided on these topics. We are also developing a depository of information such as spices to compensate for the salt limitations, which the patient can access when they wish.





DSS and Psychology

In recent years, more and more studies highlight the importance of psychological interventions to help patients to lead a fulfilling life after diagnosis of chronic diseases. Current psychological approaches to the management of chronic diseases are focused on interventions that aim to achieve increased self-management, behavioural and cognitive

each profile. An innovative task of the project is based on the development of an artificial intelligence able to process speech and physiological parameters monitored during a semi-structured phone interview between familiar caregiver and patient and recognise the psychological profile as shown in figure 01.

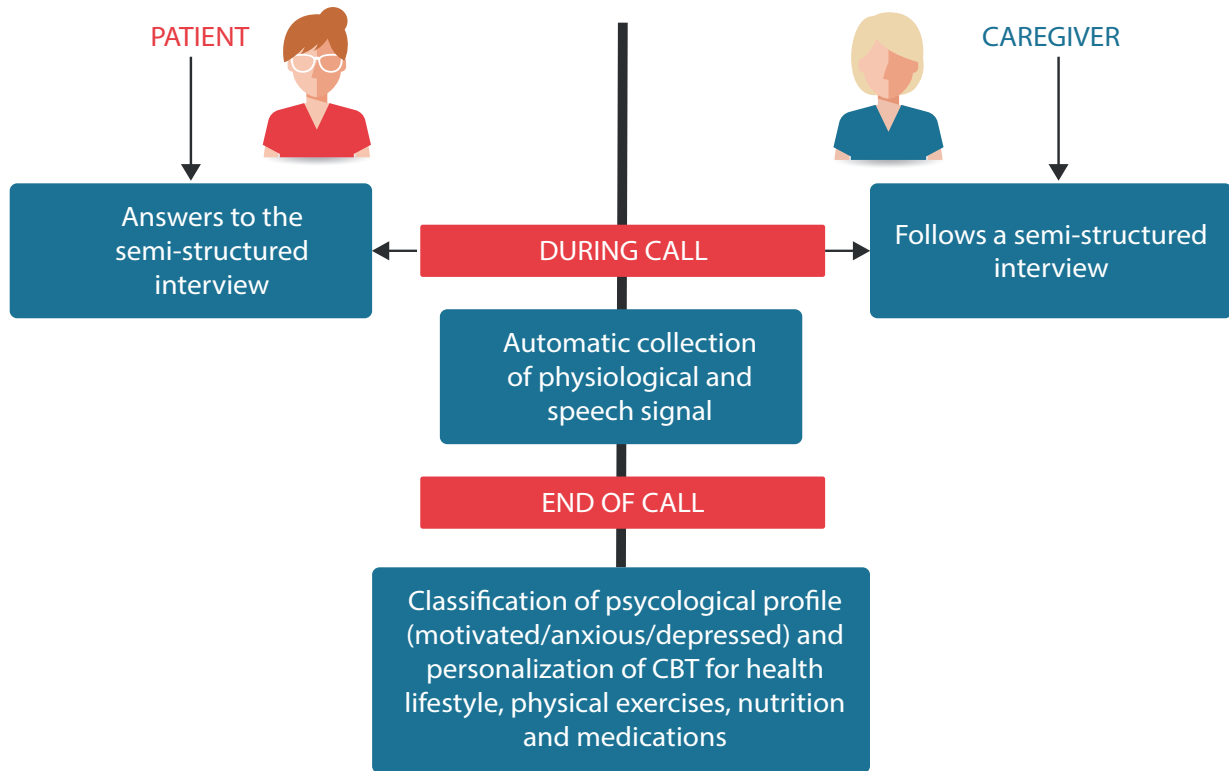


Figure 01 Semi-structured phone interview

change rather than eliminate the disease. In this scenario, HeartMan is one of the first European projects which proposes to make behaviour changes for the management of CHF dealing with an integration of strategies based on cognitive behavioural therapy (CBT) and mindfulness exercises. Researchers are defining personalized CBT to better deal with clinical advices mainly related to health lifestyle, physical exercises, nutrition and medications. Each patient will be psychologically profiled in one of three main groups - motivated, anxious and depressed - and CBT strategies will be personalized for

Moreover, in HeartMan system mindfulness strategies will be adopted to reach awareness of the present condition and benefit from everything that happens every day, improving receptivity to the interventions and reclaiming a healthier life. Mindfulness exercises will be developed and clinically validated during next months. They will be mainly based on audio, video and gaming stimuli to motivate patients to focus on what makes life worthwhile and to deal with intrusive thoughts such as loss of independence, feeling restricted in their everyday lives. All these solutions will be integrated into a mobile decision support system.

The sensing wristband

Bittium has developed the first prototype of the HeartMan sensing wristband. Device offers optic heart rate monitoring with heart rate variability, activity monitoring with 3-axis accelerometer, galvanic skin response and skin temperature.

GSR (galvanic skin response) is based on Philips EmoGraphy technology and besides skin conductance, device also calculates estimations on cortisol levels of the subject. Optic Heart Rate measurement is also based on module manufactured by Philips and this is the latest generation optic solution. With activity monitoring 3-axis accelerometer provides accurate data about patients movement for further analyzing.

Whole package has been integrated to

wrist watch like housing which offers easy solution to patients to make needed daily measurements. With wireless Bluetooth Low Energy communication to mobile phone and with separate mobile app developed also by HeartMan project data transfer and communication between patient and caregivers is smooth and caregivers can focus their work to patients who needs more focused monitoring and guidance.





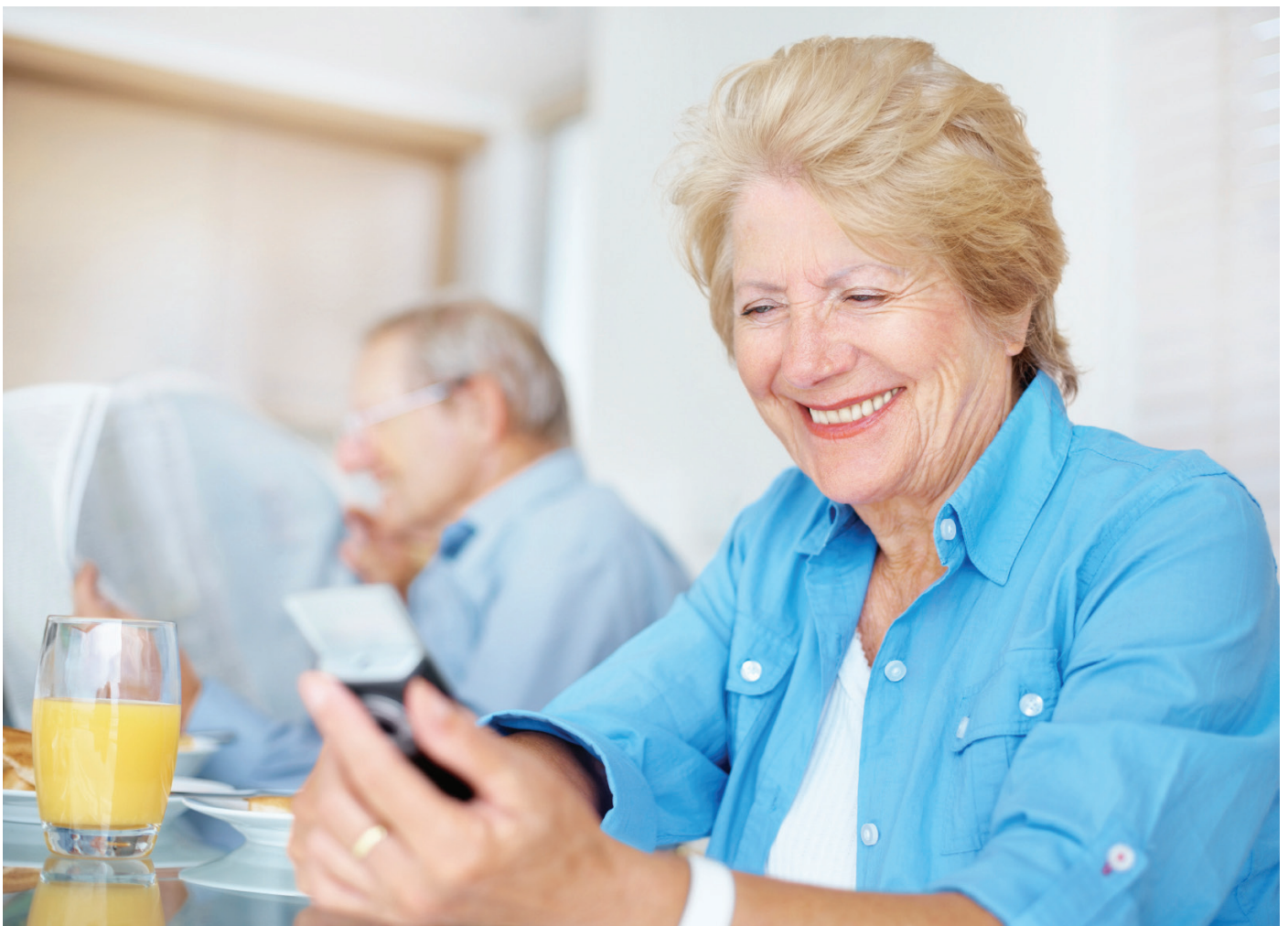
Human-centred approach

Since we use a human-centred design approach in HeartMan, heart failure patients have been involved in the project from the early beginning. Both in Belgium and in Italy, heart failure patients have participated in a diary and interview study. The purpose of this study was to understand the everyday context of heart failure patients as well as their problems, needs and wishes.

The study revealed several interesting and relevant insights regarding heart failure patients. For instance, we learned that for many patients medical incidents such as a heart attack or surgery has been quite a traumatic experience. Also, we now better understand how patients manage their

disease on a day-to-day basis (their partner or children usually play an important role here), and we were able to map the challenges they experience regarding therapy adherence (knowing what one can and can't eat is one thing, but actually adhering to all dietary rules is another).

The results of this study were translated to user requirements, which the consortium has used as a starting point for creating a first conceptual design of the HeartMan system. The next step in involving patients in our project will be to evaluate this design, and to collaborate with patients to further detail the design.






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