

# A new path for cardiac rehabilitation

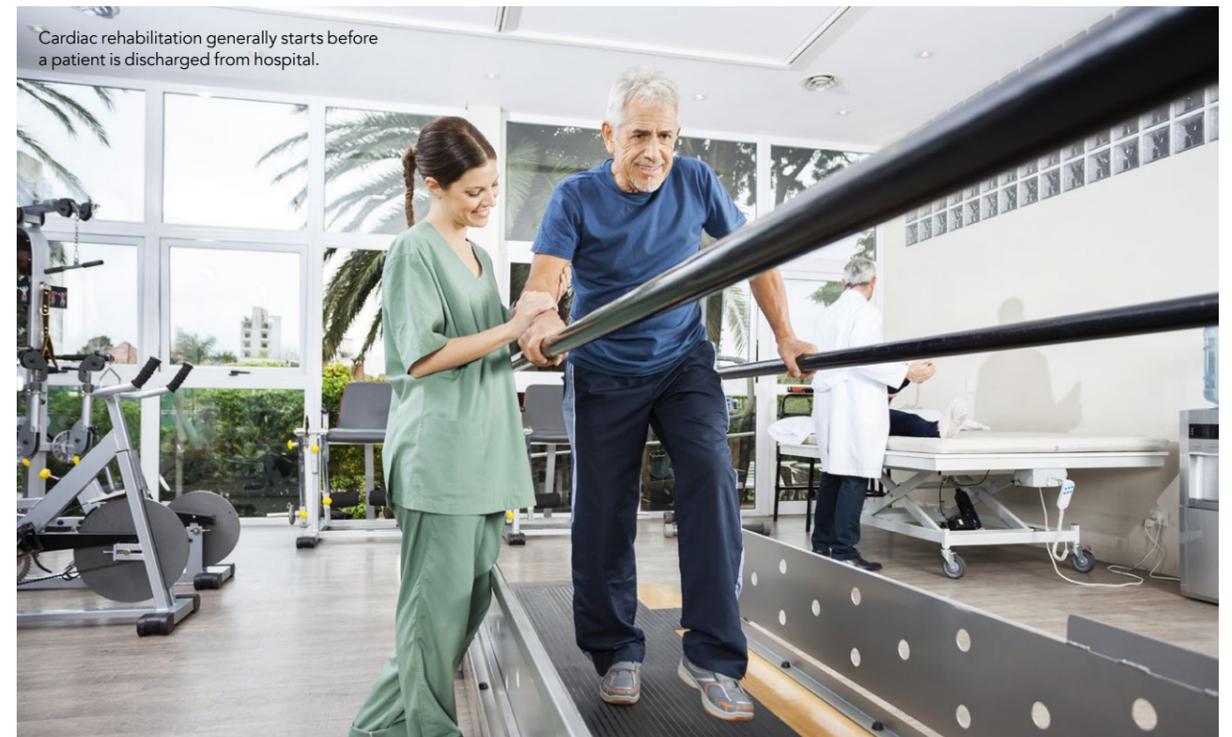
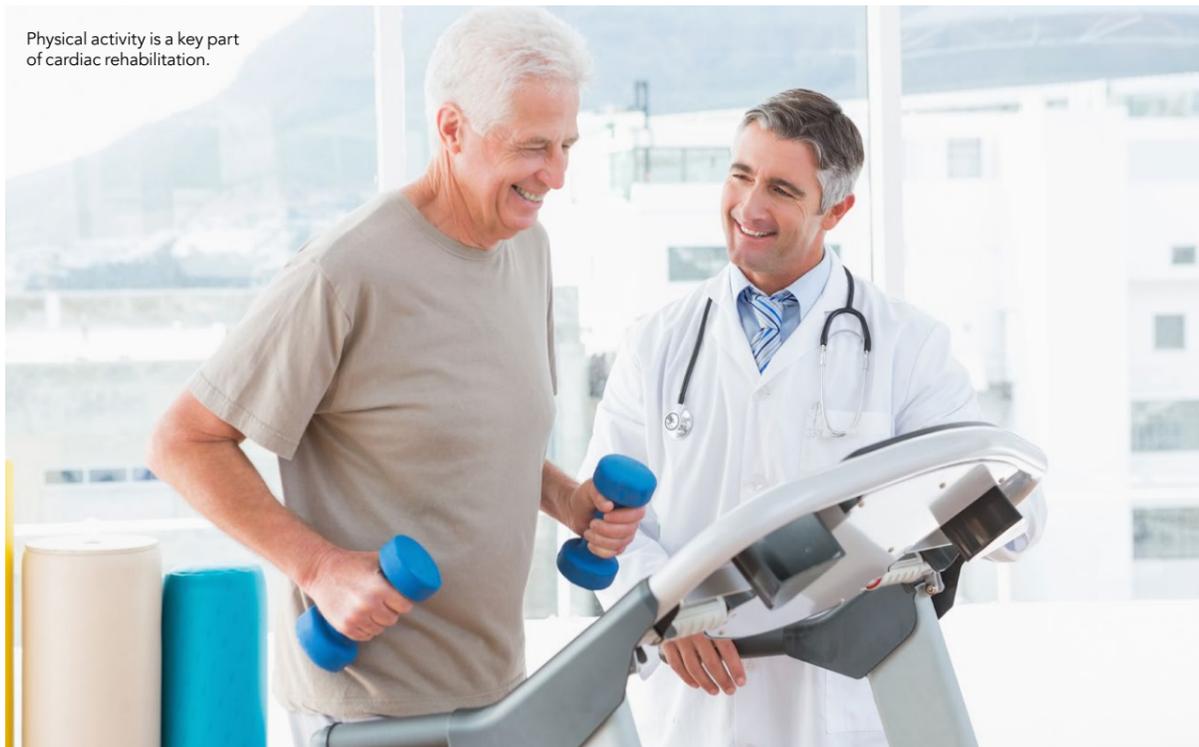
Cardiac rehabilitation (CR) is commonly recommended for patients recovering from a cardiac event, such as a heart attack. CR is typically an exercise-based programme and traditionally takes place in an environment where the patient can be monitored. PATHway (Physical Activity Towards Health) is a technology-based platform for at-home CR. Developed by CVEP Leuven at KU Leuven and nine other international partners, PATHway offers an exciting and effective alternative to traditional CR.

Cardiovascular disease (CVD) is the collective term given to illnesses that affect the heart and/or blood vessels. CVD is a leading cause of death and disability worldwide, accounting for one in every four deaths globally in 2008. There are many different types of CVD, including coronary heart disease (caused by a blocked or reduced blood flow to the heart, which can lead to heart attacks), strokes (caused by a blocked blood flow to the brain, resulting in possibly fatal brain damage), peripheral arterial disease (caused by blocked arteries leading to the limbs), and aortic aneurysms (caused by a weakening of the main artery leaving the heart). In the UK, an ageing population gives rise to 2.3 million people living with coronary heart disease, and an acute myocardial

infarction (heart attack) occurs once every three minutes.

Whilst the direct cause of CVD is as yet unknown, there are multiple known risk factors that greatly increase a person's risk of developing CVD. Such risk factors include high blood pressure, high blood cholesterol, smoking, alcohol consumption, stress management, inactivity and being overweight. Other factors such as a family history of the disease, age and gender can also impact the chances of developing CVD. However, these risks cannot be reduced by modification. Factors such as inactivity and high blood pressure can be altered by lifestyle changes to reduce a person's risk of CVD and are thus targeted in cardiac rehabilitation (CR).

Physical activity is a key part of cardiac rehabilitation.



Cardiac rehabilitation generally starts before a patient is discharged from hospital.

CR is designed to reduce the risk of new cardiovascular events, control the symptoms of CVD and to limit the physiological and psychological effects of CVD. Exercise training is a core component of CR, but diet, stress management and lifestyle support are consistently recommended in a comprehensive CR programme. CR occurs in three phases: phase 1 (hospitalisation after an acute cardiac event), phase 2 (ambulatory rehabilitation in the hospital), and phase 3 (home and/or community-based maintenance of rehabilitation). CR programmes traditionally focus on "monitored exercise and aggressive risk factor reduction in medically supervised sessions" (BMJ, 2015). Despite CR's demonstrated ability to reduce mortality and morbidity rates following a cardiac event, surprisingly few patients participate and adhere to the recommended physically active lifestyle.

After a heart attack, phase 2 CR participation has been reported to be as low as 15%, and dropout rates are also high. Participation in phase 3 CR is even lower than phase 2, meaning extremely low numbers of patients are continuing with their long-term rehabilitation. This

places patients at a greater risk for a second cardiac event, so why are so few people taking part?

The poor participation in CR has been reported as partly due to travel distance, lack of time, and low self-belief. New

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research, performed by Cardiovascular Exercise Physiology (CVEP) Leuven at KU Leuven, indicates technology-based, personalised home-based workouts and lifestyle coaching could overcome these barriers and dramatically change CR participation rates, thereby reducing the risk for new and repeated cardiovascular events.

### E-HEALTH AND THE PATHWAY TO HEALTH

Technology has already infiltrated and become integral in many aspects of life, and its place in healthcare is growing. e-Health encompasses a range of technologies from electronic health records (making it easier for different healthcare professionals to access a patient's data) to telemedicine (medical

treatment from a distance) and m-Health (using smartphones to provide information and real-time monitoring of a person's health, such as smart watches with inbuilt heart-rate monitors).

By offering an exercise and lifestyle program based at home, the restrictions on patient participation are lessened. In a collaboration between CVEP Leuven

researchers and nine other European research partners, a combination of telemonitoring, tele-coaching and e-based learning is being trialled as a home-based alternative to traditional CR. This program is known as PATHway (Physical Activity Towards Health).

PATHway is the first system to provide a comprehensive and personalised technology-enabled CR programme. PATHway enables patients to perform training sessions in the comfort of their own home. The system uses a computer application, a heart rate monitor and physical activity tracker, a camera capable of depth and motion recognition, a device to measure blood pressure, and sophisticated algorithms to design exercise sessions based on the patient's

Physical activity can take many forms.



preferences and their physiological response to exercise. With this technology, the PATHway platform delivers exercise programmes whilst monitoring patient responses to design a unique healthy exercise programme tailored specifically to the patient's health status, abilities and preferences. The PATHway system is still undergoing optimisation, but CVEP's work provides key insights into the efficacy of this "telerehabilitation".

#### TRIALLING TELEREHABILITATION

The PATHway platform has undergone iterative rounds of trials in recent years. A study in 2016 reported 75% of participants expressed at least a medium interest in receiving CR via a technological platform, with interest decreasing with increasing age. This suggests platforms such as PATHway could become increasingly popular in the future as more CVD patients would be more technologically literate. Internet use was found to be high across the participants, however, suggesting age might be less of a barrier to telerehabilitation than previously anticipated.

**PATHway is the first system to provide a comprehensive and personalised technology-enabled CR programme.**

Since the 2016 trial, PATHway has evolved to include features such as a live chat, personal and group event calendars, and a visualisation of "Good habits" generated from the patient's answers to a lifestyle questionnaire. The latter feature is graded by colour to show what habits (health behaviours) should be changed, what behaviours could be changed, and what behaviours are "good". PATHway then asks a couple of questions to ascertain the patient's willingness to change their habits and will offer advice on making behavioural changes if the patient is willing, or direct the patient to PATHway's education and support feature, "MyHealthyLifestyle", if they are not ready to make a change.

"MyHealthyLifestyle" contains comprehensive information and advice about improving healthy lifestyle behaviours to reduce the risk of cardiac events, including stress management, quitting smoking, reducing alcohol consumption, and healthy eating tips. The most recent iteration of the PATHway platform also includes an SMS

or e-mail feature (according to patient preference) to provide information and encouragement for the patient to achieve their health behaviour goals whilst they are not actively using the PATHway system. These latest changes in the PATHway system make the technology extremely patient-centred, enabling the patient to effectively manage their CVD from the comfort of their own home.

#### FUTURE WORK

The personalised exercise programmes and health behaviour assessments of the PATHway platform offers patients an effective technology-based alternative to traditional CR. As the technological literacy and interests of CVD patients change over time, so too will PATHway's platform. PATHway could also be used as a preventative tool, offering patient intervention before a cardiac event has ever occurred. This use of the technology can reduce a person's risk of developing CVD or improve their chances of survival after a cardiac event. Tele-rehabilitation is an exciting addition to the medical toolkit and is sure to become an increasingly effective and popular alternative to traditional CR. The work of CVEP Leuven and collaborators of the PATHway project are paving a new way forward for CR and for e-Health.



# Behind the Research

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### Research Objectives

The PATHway project uses internet-based technology to provide effective lifestyle intervention for cardiac rehabilitation.

### Detail

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### Bio

Roselien Buys is a postdoctoral researcher at KU Leuven. She holds a BSc in nursing, an MSc in Sports Sciences and a PhD in Biomedical Sciences. Her work focuses on physical activity, fitness, exercise training and sports for children, adults and elderly people with internal diseases.

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The PATHway project has received funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation Action under Grant Agreement no. 643491. PATHway: Technology enabled behavioural change as a pathway towards better self-management of CVD ([www.pathway2health.eu/](http://www.pathway2health.eu/)).

### Collaborators

CVEP Leuven researchers:

- Véronique Cornelissen
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- Jomme Claes
- Nele Pattyn
- Nils Cornelis

**KU LEUVEN**



### References

- Buys R, Claes J, Walsh D, Cornelis N, Moran K, Budts W, Woods C, Cornelissen V A. (2016) Cardiac patients show high interest in technology enabled cardiovascular rehabilitation. *BMC Medical Informatics and Decision Making* [online], 16(95). Available at: <https://doi.org/10.1186/s12911-016-0329-9> [Accessed 06/09/2018]
- Claes J, Buys R, Woods C, Briggs A, Geue C, Aitken M, Moyna N, Moran K, McCaffrey N, Chouvarda I, Walsh D, Budts W, Filos D, Triantafyllidis A, Maglaveras N, Cornelissen V A. (2017) PATHway I: design and rationale for the investigation of the feasibility, clinical effectiveness and cost-effectiveness of a technology-enabled cardiac rehabilitation platform. *BMJ Open* [online] 7, e016781. Available at: <https://doi.org/10.1136/bmjopen-2017-016781> [Accessed 06/09/2018]
- Walsh D M J, Moran K, Cornelissen V, Buys R, Claes J, Zampognaro P, Melillo F, Maglaveras N, Chouvarda I, Triantafyllidis A, Filos D, Woods C B. (2018) The development and codesign of the PATHway intervention: a theory-driven e-Health platform for the self-management of cardiovascular disease. *TBM* [online]. Available at: <https://doi.org/10.1093/tbm/iby017> [Accessed 06/09/2018]
- BMJ. (2015). *Cardiac Rehabilitation*. The BMJ [online] 351, h5000. Available at: <https://doi.org/10.1136/bmj.h5000> [Accessed 09/09/2018]
- NHS (2016) *Cardiovascular disease* [online]. NHS online. Available at: <https://www.nhs.uk/conditions/cardiovascular-disease/> [Accessed 07/09/2018]

### Personal Response

**If a patient doesn't want to participate in traditional CR, what would make them more likely to engage with PATHway?**

// PATHway can be used at any moment from the comfort of one's own house. As such, patients who feel that traditional CR is a burden on them because of transportation difficulties and time constraints, can easily get PATHway to be built into their daily life. Moreover, the patient tailoring of PATHway, along with the motivating prompts help the users to keep up with their program and remain engaged with a healthy lifestyle. //