the smart consortium

leading the field in self-management technology

The Smart Consortium is a multi-disciplinary research collaboration. It includes technology researchers, clinical researchers, and researchers with knowledge and expertise in designing usable interfaces.

Our mission

- To **undertake cutting-edge research** into new technology-based solutions for rehabilitation and self-management for people with long-term health conditions.
- To ensure that the findings from developing and evaluating these solutions are **fully disseminated into clinical practice**, to the public, to other researchers, to policymakers and to industry.
- To **encourage collaborations with industry** so that prototype technologies can move into mainstream healthcare delivery.
- To **foster new research partnerships** which can take forward new and related projects.

The Smart Consortium was established in 2003 with a grant from the Engineering and Physical Sciences Research Council. This was part of its EQUAL programme: extending quality life for older and disabled people.

The first grant was to research and develop technology which could support people to self-manage rehabilitation at home after a stroke.

A second grant followed in 2008. This enabled us to examine how technology might support the self-management of long-term conditions.

Our Director, Professor Gail Mountain, is also the Principal Director of the EPSRC's wider 'knowledge transfer' group known as KT-EQUAL.

Together with two other EQUAL-funded consortia, the Smart Consortium forms a significant element of the KT-EQUAL programme of work.

Our researchers

University of Sheffield

Gail Mountain

Improving older people's quality of life through appropriate interventions and good design, and by facilitating participation

Mark Hawley

Assistive technology; telecare and telehealth; digital healthcare

Sue Mawson

Improving quality of life of people with long-term conditions; capitalising on innovations in sensor and digital technologies

Simon Brownsell

Developing, implementing and evaluating telecare and telehealth enabled services for the benefit of user and provider alike

University of Bath

Chris Eccleston

Evidence-based pain; treatment innovation and development; cognitive-effective mechanisms of pain and disability; child and family influences in pain

Ed Keogh

Psychology of pain; sex differences in pain; attention and pain; e-health; use of technology within the context of pain

Bath Institute for Medical Engineering

Nigel Harris

Developing appropriate technology to support home-based rehabilitation and independence of people with long-term conditions

University of Ulster

Norman Black

Collaboration between computing, biomedical engineering, health and sports science to advance connected health applications

Chris Nugent

Designing, developing and evaluating smart environments for ambient assisted living applications

Paul McCullagh

Applying computing to assisted living; advances in multimodal human-computer interaction

Jane Zheng

Intelligent data analysis; data integration; pattern recognition and feature selection techniques; assistive technology; activity recognition and analysis; motion/gait analysis

Newcastle University

Peter Wright

Participatory design of social technologies and services in health, culture and community sectors

Our expertise spans a wide range of disciplines from several UK universities. This mix of expertise, skills and perspectives helps us keep our focus on the needs of the end user in everything we do. It also means we can respond effectively to the technological challenges of our research.

Smart Rehabilitation 1

Technological applications for use in the home

Our initial project was to develop technology so that stroke survivors could self-manage their rehabilitation in their own homes.

How it works

Wireless sensors are attached to the user's affected upper limb and chest using sports-style garments. When the user undertakes an exercise with their affected limb, data generated from movement is relayed by the sensors to a 'decision support interface' on a computer. The user is then able to view progress on screen and compare their movements with a normal arm.

The exercise choices on the system are identified in advance by rehabilitation professionals. Users are given a number of recommended exercise options, aimed at improving their arm function, and asked to undertake them several times each day. Simple games are available to help maintain interest and motivation.

Future for the system

Concurrent work led by Philips R&D in Germany and user-testing in the Netherlands led to collaboration in 2006. However, this did not result in a mainstreamed product at the time, largely because the market was not ready to embrace technology for rehabilitation.

The situation now, just a few years later, is radically different. Society has become aware that resources for rehabilitation cannot match existing and future demands. So we plan to capitalise on the knowledge gained from this project to develop marketable devices.

Our research outputs also continue to inform other, more advanced work.

This research was supported by a grant from the Engineering and Physical Sciences Research Council (United Kingdom Grant ref. GR/29089/01).

"This has made a real difference to my life. I'm going to carry on with it for the next 40 years!"

Participant

Self-management supported by assistive, rehabilitation and telecare technologies

Smart Self Management 2

This research was supported by the following grants from the Engineering and Physical Sciences Research Council: EP/F002815/1; EP/F001916; EP/F001959; EP/F001835.

"We all need goals and targets. I think you do in any walk of life."

Participant

Our second major project has been to create a Personalised Self-Management System — an integrated system for use in the person's own home, consisting of a touchscreen 'home hub' and a mobile device.

The system has specific additional functionality to meet the needs of people with four particular health conditions:

- congestive heart failure
- chronic pain
- stroke

For example, the system for people with congestive heart failure includes weighing scales and a blood pressure monitor. The content of each system has been developed with reference to best practice for these conditions.

Our aim is to help users to independently manage the consequences of their long-term condition, and to retain or improve their quality of life by increasing physical activity. This process is called self-management.

We are also aware of the importance of helping people to independently continue with rehabilitation exercises if this is important to their condition.

How it works

To use the system, the individual first identifies realistic lifestyle goals which can be achieved through graded physical activity. The device guides and motivates the user in working towards their identified goal, providing individualised feedback based on their progress and educational information about their condition.

The system also includes therapeutic rehabilitation exercises which are specific to the user's condition and progress so far.

We have tested our prototype system with people with congestive heart failure and people with chronic pain, leaving it with them to use in their daily lives for a period of time. Initial results are very promising.

The system for people with stroke incorporates a novel technology in the form of a smart insole to be placed in the shoe. We are now evaluating the insole with people with stroke to determine the value of the feedback it provides for improving balance and gait. This version of the system has presented greater challenges, since the self-management concept is relatively new to this group.

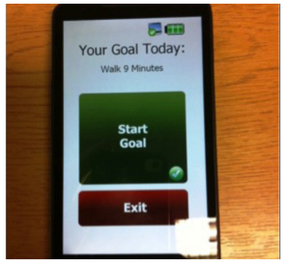
Smart 3
Holistic
Self Management

Self-management technology for co-morbidities

This follow-on project is extending the remit of the Personalised Self-Management System to meet the needs of people with chronic obstructive pulmonary disease. We are moving towards our goal of adding elements to the core system to meet the needs of people with other long term conditions or a mix of co-morbidities.

We are also looking at ways in which the Personalised Self-Management System might be improved, for example by increasing the extent of individual user personalisation.

This project is funded through the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care in South Yorkshire.



"Sometimes it's easy to become idle. If you have something that will drive you on a bit, it's good!"

Participant

Why our work is important

We are determined to build technologies that people really want and can use — because we know that any one of us might need to use similar devices in the future. Our aim is to help people take control of their lives, and, as a result, to enjoy living.

- In the future, we can all expect to receive less directly-delivered healthcare because more and more people will have long-term conditions. People will be expected to manage their own conditions, rather than being reliant on healthcare services. We have accommodated this scenario by designing devices that can be used by the person in the absence of a healthcare practitioner, but with therapeutic content specific to the needs of each person's particular long-term conditions. Alternatively, devices can be customised within the care pathway in a joint activity between the user and practitioner, which means the user is then able to continue to use them after they are discharged from outpatient care.
- People with long-term conditions often have to combine rehabilitation with managing the implications of their illness on quality of life. Our technology is focused on addressing this previously neglected combination.
- Current technology for self-management tends to be limited to medical monitoring and providing education, so that the person only learns to manage the physical aspects of their condition. Our technology moves beyond this limited functionality to a more comprehensive paradigm that integrates knowledge, choice and decision-making to achieve goals which have been identified as important to people's lives, working within their overall therapeutic plan.
- The potential of technology, particularly as a means of persuading individuals to adopt a range of self-managing behaviours, is not being adequately exploited. Our work aims to achieve this.
- People can have more than one long-term condition. Our self-management technology is designed so that it meets the needs of people with more than one condition. Most existing technology is intended for people with only a single condition.

Our key findings to date

- There is not enough practice and associated research in how to help people with specific complex long-term conditions to self-manage.
- Most existing views of self-management focus on educating people about their condition so that they can manage it more effectively. Our work confirms the importance of including self-managed rehabilitation alongside self-management for many long-term conditions, so that people can maintain function and in some cases regain it.
- Self-management technology can be crucial in helping users to maintain motivation and change their behaviour. If devices are well-designed, technology features can be used to support and sustain these changes. Equally, badly-designed or malfunctioning devices can rapidly erode motivation.
- The Personalised Self-Management System has been welcomed by users who have been involved in its testing. People with long-term conditions need a portable, personalised solution which can enable them to self-manage while at the same time carrying on with their daily lives.
- Evaluations of our devices for people with congestive heart failure and chronic pain have confirmed that we made the appropriate design decisions and technology choices earlier in the project. Our initial idea, to identify and integrate existing devices and exploiting their potential rather than to engineer new solutions, has been justified.

kt equal

Exchanging Knowledge | Extending Quality Life

As leaders in the wider KT-EQUAL group, we engage with older people and those with long-term conditions, with policymakers, health and social care practitioners, with industry, and with researchers from in related areas of work.

The events listed on the right are a sample of those convened through KT-EQUAL by members of the Smart Consortium to explore the relevance of our work to related topics and with other research groups.

Visualisation for better health care
June 2011, Glasgow

Design ahead
March 2011, Bath

Rehabilitation technologies for stroke
January 2011, Southampton

imed: serious apps for mobile healthcare
May 2010, Bath

Robotics: supporting personal independence and rehabilitation
November 2009, Hertfordshire

Assistive technologies: what is their place in the mainstream market?
October 2009, Sheffield

Presentations and reports from all these events can be found on the KT-EQUAL website: www.equal.ac.uk

If you would like to receive further information, pass on your comments or keep in touch with our work, please contact:

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the smart consortium

University of Bath

Sheffield Hallam University
SHARPENS YOUR THINKING

University of Ulster

BIME
Bath Institute of Medical Engineering

Newcastle University

The University Of Sheffield.

Expert Patients Programme
Community Interest Company

The Stroke Association

British Heart Foundation