



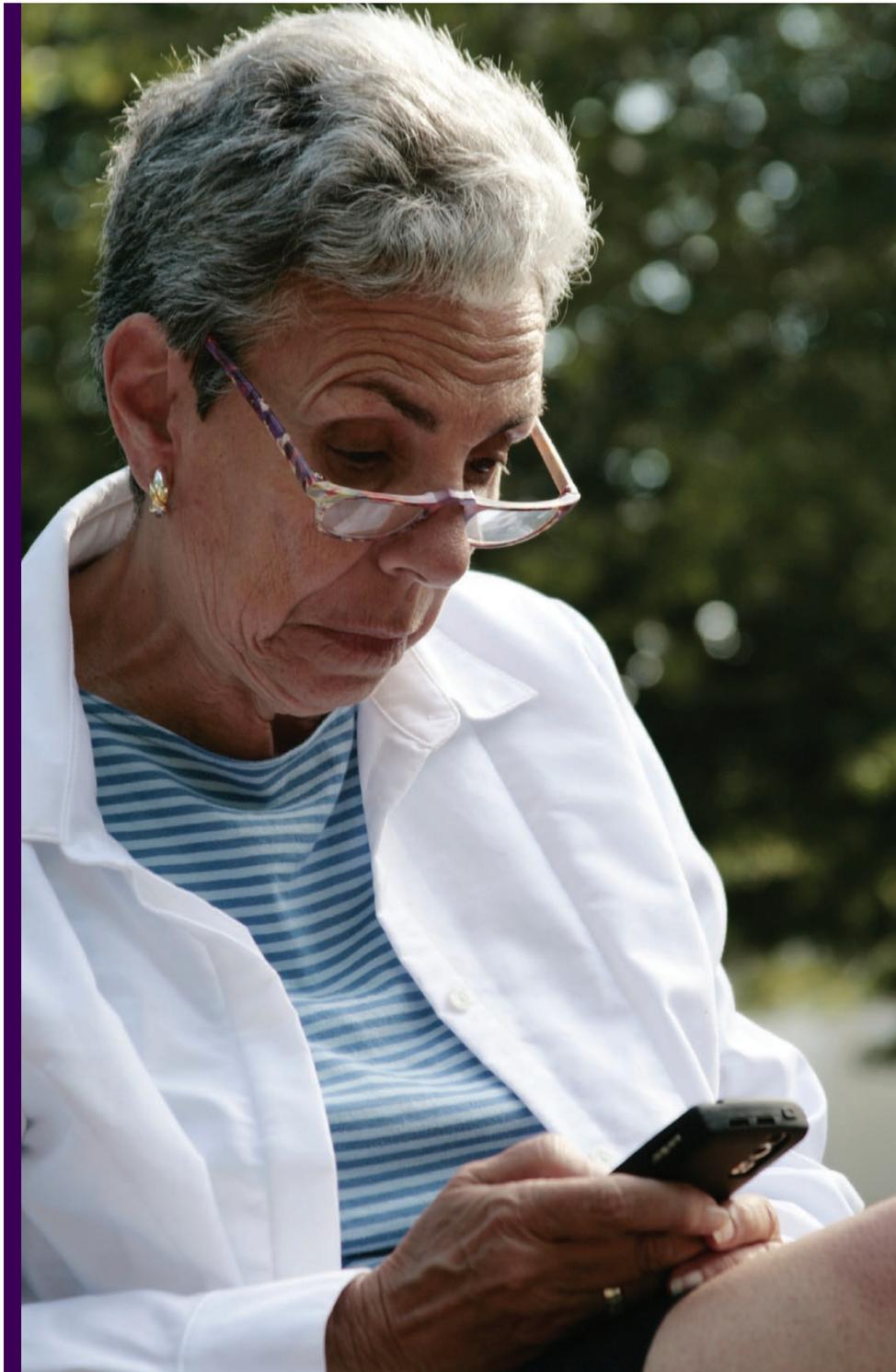
ROYAL  
ACADEMY OF  
**ENGINEERING**



# Designing cost-effective care for older people: How technology can make a difference

A one-day meeting

Organised by Age UK and the Royal Academy of Engineering Panel  
for Biomedical Engineering



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Keeping people out of hospitals and supporting them so that they can live safely and comfortably at home are challenges that technology and engineering can help address.

## Introduction

As people live longer, the health and social services are under increasing pressure to deal with conditions related to frailty. Keeping people out of hospitals and supporting them so that they can live safely and comfortably at home are challenges that technology and engineering can help address.

Engineers have a crucial and continuing role to play in healthcare innovation for the UK's ageing population. As well as developing new technologies, they are working with patients and clinical staff to improve and develop new systems of patient care.

This report is a summary of presentations given at a one-day conference that addressed perspectives of caring for the UK's ageing population and provided insights into the role that engineering technology and design can play in providing more effective and cost-effective care and support.

Please note that the views and opinions of the speakers are not necessarily those of Age UK or The Royal Academy of Engineering.

Engineers have a crucial and continuing role to play in healthcare innovation for the UK's ageing population.

## Message of support

*"This is a timely and important conference and I'd like to welcome you to Sheffield and to my constituency. One of the great achievements of our society is the increased life expectancy that we can all expect, but with it comes enormous challenges. We need to be able to ensure that people can not only live longer lives, but enjoy them to the full. It is one of the major issues facing us as politicians, and is reflected in the way that I am increasingly contacted by constituents and their families about issues associated with ageing.*

*Issues such access to care, adaptations to people's homes, or expensive medical procedures are becoming increasingly commonplace, and as a society we need to respond better to them, and quickly. Every part of society needs to respond to this challenge and I'm delighted that, as engineers, you are recognising your contribution in this conference. Engineering has a vital role to play in helping to address the issues of an ageing population, so I hope your discussions today will be productive and informative, and I look forward to hearing about them."*

**Paul Blomfield**  
**MP for Sheffield Central**

...use of technology not only creates efficiency savings but has positive outcomes for people. It showed a reduction in the number of people being admitted to in an emergency hospital, requiring treatment in A&E or even needing to be in hospital at all.

## Age UK's perspective on the role of technology in the care of older people

**As presented by Dr Matthew Norton**  
Social and Economic Research Manager, Age UK

Age UK is in a unique position in being able to speak about the views of older people. There is significant unrealised potential around the use of technology. There is now a critical mass of evidence that technology can help in the care of older people. Yet there are only 5,000 telehealth users making use of the 1.5 million pieces of telehealth technology available to use in England. The NHS Whole Systems Demonstrator, the largest randomised control trial in the world ever held for telecare and telehealth, has provided evidence that use of technology not only creates efficiency savings but has positive outcomes for people. It showed a reduction in the number of people being admitted to an emergency hospital, requiring treatment in A&E or even needing to be in hospital at all. There is also evidence that it reduces mortality.

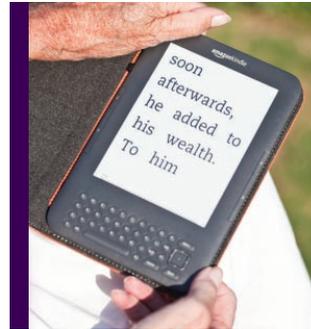
A common assumption is that older people are not engaged with technology. Age UK research shows that this is not the case - older people embrace technology but do so on their own terms. In early findings from work done with the Challenging Obstacles and Barriers to Assisted Living Technologies (COBALT) project, older people are enthusiastic about sharing their experiences of technology. Contrary to the common assumption that technology has passed older people by and that they fear it or are dubious about the value in terms of improving their lives, older people do embrace technology on their own terms: television ownership, for example, is virtually 100%. However, 5.7 million people over 65 are not online.



Older people are suspicious of assistive technology specifically designed to deal with the difficulties that arise from old age and do not view it in the same way as mainstream technology. They have concerns about the stigma of using this technology; they are concerned about the loss of privacy and confidentiality and the loss of social interaction.

Assistive technology is not always seen as relevant and many cannot imagine using it. With no opportunity to 'try before you buy', no lease scheme and poor customer service, older people are reluctant to embrace it.

Industry has a poor understanding of the needs of older people. There is a very poor social science evidence base of those likely to benefit from it. Technology is generally designed to address a disability rather than focusing on how to enhance the lifestyle and meet the aspirations of older people. Age UK is beginning to address this through pioneer groups where end-users work with industry to establish what they want.



## Policy context: Changing expectations of later life

**As presented by Professor Tom Kirkwood CBE**  
Associate Dean of Ageing, Newcastle University

Life expectancy is increasing in the UK at a significant rate of around two years a decade. Increased lifespan is a great achievement for humanity and needs to be viewed in relation to the benefits that it brings and not just in terms of the burden on health and social care. Longer lifespan does mean that we need to address our infrastructure (for example the pension system was not designed to cope with current levels of life expectancy) but it is also an enormous economic good. In 2005, the House of Lords Select Committee for Science and Technology identified that industry was not recognising or taking advantage of the commercial opportunities that increased life expectancy presents. Little has changed since then.

Ageing concerns us all; however, ageism is endemic and needs to be addressed so it becomes no longer acceptable.

We need much better information about older people. What is their experience of:

- health
- technology
- daily living
- their own aspirations?

There are patches of information available and the NHS holds data about health but only of those who have needed its services; information about those without health issues is scarce.

Newcastle University is undertaking a study of people 85+. The study looks at genes, nutrition, lifestyle, environment and socioeconomic status. Of the 1,041 participants, all have health problems, with the majority having three or more health issues.

As a result, healthcare configuration is not good for them as they each have to attend separate outpatient clinics

for each condition. This can lead to the prescription of drugs that exacerbate a different health condition dealt with at a different outpatient appointment. These issues are now being addressed by means of reviewing healthcare configuration clinics for older people. While the majority have three or more health conditions, 78% of participants self-rate their health as good, very good or excellent.

The study is assessing the ability of older people to carry out daily living activities. A quarter of all men could do all the activities in question; and a sixth of all women. Scientists are beginning to understand ageing better, and are recognising that the ageing process

is more malleable than we previously thought. Some of the contributing factors to ageing are bad lifestyle choices and a poor socioeconomic environment. Healthy lifestyle choices, exercise and engagement in society and with other people enhances repair.

With this increased understanding of ageing and the increase in numbers of people living into old age, we urgently need to adapt our infrastructure for an ageing population. We need to change attitudes across society and older people have to believe in their own abilities. Older people are an under-acknowledged asset with underutilised mental capital.



The role of technology is to improve the cost-effectiveness of the delivery of care, not to replace it.

## Political and policy landscape

### As presented by Dwayne Johnson

Strategic Director, Health and Community, Halton Borough Council  
and Joint Lead, Association of Directors of Social Services Older People's Network

Historically, there has been a decrease in spending on social care in real terms. Age UK's report *Care in Crisis* identified a funding gap of £500m for 2011/12. With cuts being made in overall spending for older people, this means that this group is not having their needs met or needing to supplement what is provided by the State. Councils organise and arrange care differently which means that the package of care an individual receives depends on where they live. The role of technology is to improve the cost-effectiveness of the delivery of care, not to replace it.

The Health and Social Care Bill 2012 envisages greater integration of health and social care through commissioning and health and well-being boards. The Social Care white paper due in Summer 2012 is likely to focus on technology supporting preventative strategies and the integration of health and social care.

The *3 Million lives* project was set up by the Department of Health. The Department believes that at least three million people with long term conditions and/or social care needs could benefit from the use of telehealth and telecare services. On 19th January 2012, Paul Burstow, Minister for Care Services committed to work with industry, to support the NHS, social care and professional partners to achieve this level of change over the next five years. Local organisations are being encouraged to use telehealth and telecare and to be innovative in working with new technology to keep people at home.

In December 2011, the government published the headline findings from the Whole Systems Demonstrator programme which was the largest randomised control trial in the world for telecare and telehealth. In Newham,

Kent and Cornwall 6,191 patients took part. The trials resulted in:

- a reduction in tariff costs of 8%
- a reduction in bed days of 14%
- a reduction in elective admissions of 14%
- a reduction in A&E visits of 15%
- a reduction in emergency admissions of 20%
- a reduction in mortality rates of 45%.

Personal care budgets are gaining momentum and progress is being made towards the development of personal health budgets. It is likely that there will be a merger of health and social care personal budgets. This means that the consumer will take on the role of purchasing technology; so the assistive technology industry needs to move to operate in a consumer market. Currently, older people do not see the value of it and are unaware of how to find it.

## Halton Borough Council case study

In 2001, a review team including the Care Quality Commission concluded Halton Adult Social Care was not serving people well.

Halton then looked at how to make changes to improve people's lives and outcomes. They decided to use telehealthcare and over the last seven years have increased their investment in it. There are now three to four thousand people in the borough on telecare and nationally the borough has the lowest rate of admission to residential care. There has also been a reduction in admissions to hospital.

Betty is 96 and lives at home in a bungalow. She has limited mobility and some cognitive impairment. She had a number of falls and admissions to hospital. Her family were concerned for her and wanted her to go into a care home but Betty wanted to stay at home. Halton adult social services put a bed sensor, a chair sensor and a community alarm into her home. She has now had these for two years. The telecare has helped her to stay in her own home and avoid admission to hospital on a number of occasions as she has been able to receive medical attention quickly after experiencing a fall.

Peter has learning difficulties and lives in a supported home. He has epilepsy and experiences fits daily. He is also a wheelchair user. Peter has been able to stay in his supported home as he has a nocturnal epilepsy monitor and pager so that staff are able to attend him when alerted to the fits he has in the night. Prior to this he had staff going in every night which was contributing to the view that he needed to move to a residential care setting.

Halton has found that telehealth:

- improves the quality of life
- promotes social inclusion
- maximises independence
- increases opportunities
- reduces and manages risk.

Outcomes for individuals are:

- independence
- carers improved quality of life
- enhancement of re-ablement
- dignity
- reduced social isolation
- fewer hospital admissions.

Some 10% of the UK's gross domestic product (GDP) is spent on healthcare. With increasing lifespans this presents a huge challenge.

## Financial picture

**As presented by Anita Charlesworth**  
Chief Economist, Nuffield Trust

There is £140bn of public expenditure spent on welfare each year. A large proportion of that is on older people who account for 20% of all public spending. Public spending on older people is broken down as follows:

- 59% on welfare (such as state pension)
- 35% on health
- 6% on social care.

Some 10% of the UK's gross domestic product (GDP) is spent on healthcare. With increasing lifespans, this presents a huge challenge. In real terms the growth in spending on health in the NHS has been flat from 2010 onwards. The population is growing and so spending per head is falling.

The Office for National Statistics (ONS) projects a significant rise in people living not only past 50 but to be 70+.

The average health costs for over 50s rise exponentially because of increased emergency admissions and the tendency for people over this age to have multiple health conditions or chronic diseases. In addition to emergency admissions, there is a high incidence of treatment for cancer, renal disease and other chronic diseases.

With projections based on current levels, the increase in need is likely to equate to an extra £1bn of health spend a year. The emerging issue is how to provide enough resources to meet the need.



In social care, expenditure is already lower than demand. The 2011 Dilnot commission conducted an investigation into the future funding of long-term care and concluded that an increase in spend of 50 - 80% would be needed.

The Office for Budget Responsibility has carried out its own projections based on policies remaining as they currently are and concludes that by 2060, *'in the absence of offsetting tax revenues or spending cuts this would eventually put public sector net debt on an unsustainable upward trajectory.'* So unless tax is increased or spending cut, the spending required to meet these health and social care costs is unsustainable.

The Office for National Statistics (ONS) projects a significant rise in people living not only past 50 but to be 70+.

Technology is an enabler and, for it to bring about benefit, it must be integrated into the other things that we do.

## Technology and the home

**As presented by Professor Peter Gore**  
Managing Director, ADL Smartcare Ltd

80% of people would prefer to stay at home in older age and evidence suggests that it is cheaper than living in any other setting. The mean average cost for a person for a year in care homes is £24,604, while a nursing home costs £34,044. *The Guardian* quoted the cost of staying at home as £7,000 per annum (*the Guardian*, 'Free homecare available to few elderly', 16 May 2012).

People go into residential and nursing care as a result of:

- a fall or fracture
- acute illness
- general deterioration
- as a result of increasing pressure on their carer
- loneliness.

Technology is an enabler and, for it to bring about benefit, it must be integrated into the other things that we do. Assistive technology helps people to do the things they used to do.

Technology can:

- provide function restoration (allow people to do what they used to be able to do)
- reduce care needs or the burden on the carer
- slow deterioration
- maintain the support network

Costs for 30 minutes of home care seven days a week over five years are estimated as £15,000 - £16,000. Equipment cost is estimated at £50 - £100. A retrospective study has shown that those with assistive technology need four hours' less care a week than those without.

Another 18 month study showed an average of 10% reduction in deterioration by those using assistive technology.

Maintaining support networks is vital; studies have shown that self-perceived loneliness is as significant a health issue as smoking. Therefore, when considering assistive technologies, it is important to ensure that the technology does not isolate the person from their support network.

Some of the challenges of getting assistive technology utilised to full benefit are design, the choice of technology, the logistics and accessibility of getting the technology for the user and the evaluation of its impact.

Older people need to be viewed as consumers and products designed accordingly. Older people do not want specially designed products for them; they want products that work and fit with their lifestyle, design aesthetics and aspirations as people. Specialists need to engage and work with

industry to share their knowledge of specifications (for example disability standards) so that products can be developed with mass appeal while meeting these standards.

Frequently, technology is abandoned because it does not match the requirements of the user. Assistive technology is still bought as a one-off, making it expensive and difficult to access.

Throughout history, engineers have helped to make great improvements in public health: the construction of the London sewerage system over nine years helped eradicate cholera in London and the system is still in use today. Now, engineers have a valuable role to play in this new market: the challenge is for engineers to do what they do smarter and work together with others to get better value out of what they do.

A retrospective study has shown that those with assistive technology need four hours' less care a week than those without.





## Design of care homes and assistive technologies

**As presented by Pam Turpin**  
Healthcare Consultant, Arup

For people who need to go into a care home, it is important to be able to live well and as independently as possible in a safe environment. Some 420,000 older people in England live in a care home and this figure is set to rise to 459,000 by 2019. The majority of residents are female, the average age is 84 and the average length of stay is two and a half years.

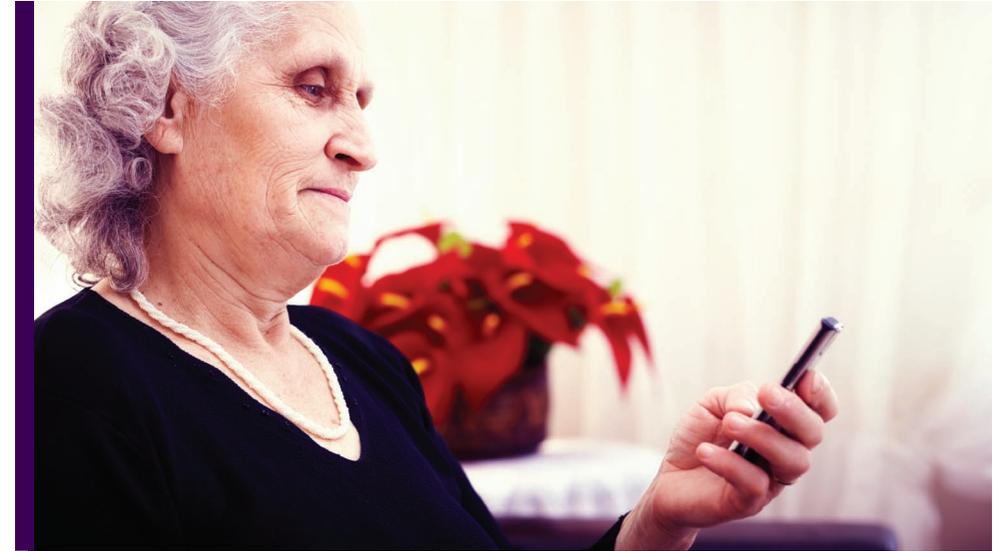
Residents usually have high support needs and frequently have a combination of impairments or health issues. Significant numbers have moderate hearing and visual impairment. Their health issues can also lead to confusion and challenging behaviour.

The design of care homes directly impacts on the independence and

self-esteem of residents. A well-designed care home allows people to be able to move around easily and has clear signposting to reduce confusion.

Key features of good design for care homes includes:

- small sized, homely familiar domestic style rooms
- space and scope for ordinary activities (such as gardening, reading, painting)
- unobtrusive concerns for safety (such as glass fronts to balconies instead of railings)
- different rooms for different functions (such as dining room and living rooms kept separate)
- single rooms big enough for personal belongings
- controlled stimuli, especially noise;
- safe outside space.



Technology has much to offer older people in care home settings and can be used to improve the quality of their lives. There needs to be a shift in how it can be used in the care home setting. Examples of good use include:

- pressure mats next to the bed that turn on the bathroom light when the person gets out of bed in the night to go to the toilet
- tablets, such as iPads, with photos to support memory recall
- Skype so that relatives not able to visit their relatives often can stay in touch.

New technologies are coming over the horizon but technology is not the only solution: the most important way forward is the co-production of technology in collaboration with users.

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Another new area under development is pervasive computing for homes...

## Data collection and looking to the future

**As presented by Professor Paul Watson**

Director, Digital Institute, Newcastle University

The Digital Institute at Newcastle University is undertaking work using sensors. The sensors provide a good way of collecting data particularly about movement. This potentially helps address those diseases affected by reduced exercise, for example heart disease and obesity. As well as collecting data on how much exercise is being taken, sensors are also able to detect the type of exercise (such as going up and down stairs) and can also show grip and manipulation (important for Parkinson's disease and could potentially help monitor the effect of drugs on a tremor throughout the course of the day).

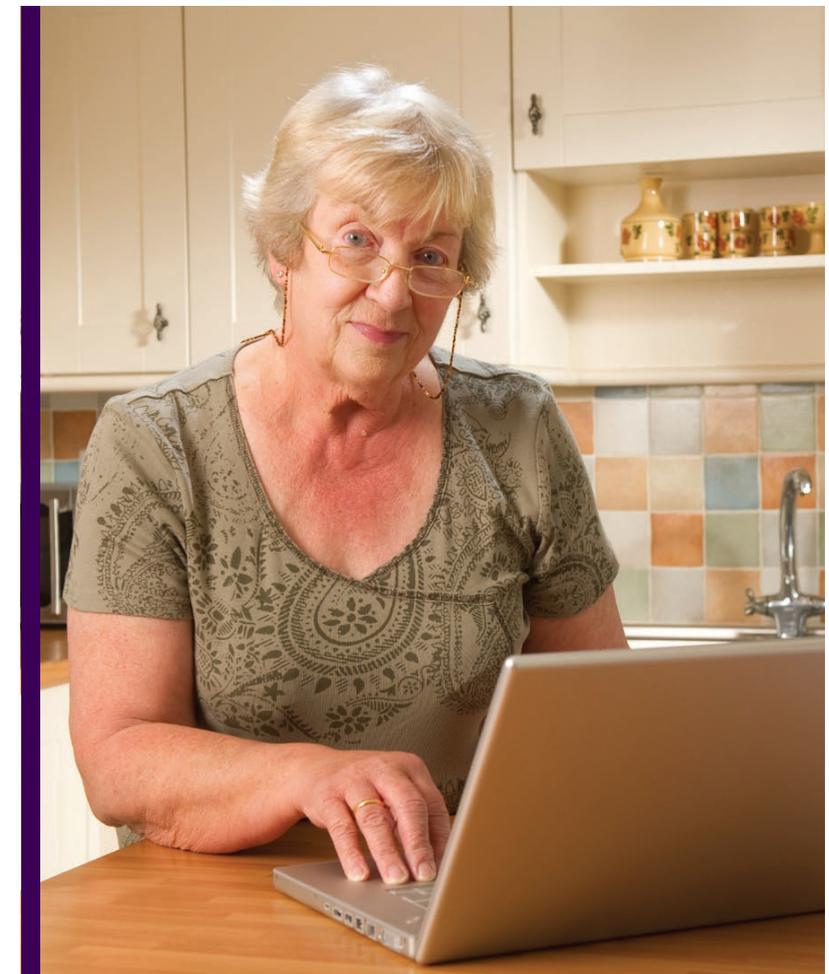
Collection of data through sensors has a great deal of potential for use in longitudinal studies. Data can be clustered together to look at patients with the same disease types which could be very useful for future research.

The advent of cloud computing is valuable in storing and having the processing capabilities for evaluating the high volumes of data collected for analysis. It is also helping to bring down the cost of developing technology and delivering services: the computing capability and storage can be rented on an as-needed basis, rather than investing in hardware and data storage capacity.

Another new area under development is pervasive computing for homes (which means the computing is taking place in the background). This technology is being explored to see if it could have a role to play in keeping people in their homes as long as possible. Utilising sensors, trackers and software, its use in a kitchen setting is currently being explored. For example, people with early stage dementia often forget the next stage of the task that

they are involved in, such as making a cup of tea. Partners or carers frequently take on the role of prompting them to enable them to complete the task independently. Now, sensors are being used to identify the activity and the computer provides an audible prompt to the user for the next step. In addition,

technology is being used to identify items removed from the fridge linking them to a recipe, identifying such actions as chopping, slicing and peeling to guide users through cooking a meal. While very much a work in progress, there is lots of potential in this new technology.





## Evaluating technologies

**As presented by Mike Biddle**

Innovation Platform Leader - Assisted Living, Technology Strategy Board

Technology can help us to live independently but we have work to do to get there. The Technology Strategy Board:

- promotes innovation and supports innovative businesses
- provides grants and contracts to businesses across the UK
- supports all types of business - pre-starts, startups, small and medium enterprises and major corporations
- supports businesses that can succeed as growth sectors in the future.

Ageing is an opportunity. The increasing number of people surviving into older age means an increase in human capital: knowledge resource and social resource. That turns the challenge into how to bring people together to stay healthy and engaged in society.

Some 44% of total UK family spend in the UK is made by people aged over 50 - this group has some affluence which presents an opportunity for businesses targeting this demographic.

£109 billion was spent on healthcare in the UK in 2006/07, with £34 billion spent on the over 65s. 69% of the total health and care spend in England is associated with long term conditions. The EU has undertaken projections that show there will be an increase of almost 100% in spend on long-term care by 2060.

Innovation and technology can help meet the demand for independent living in the UK. The Technology Strategy Board has been working on a project called the Assisted Living Innovation Platform. The project is about:

- meeting demand for independent living

- improving quality of life
- innovation and application of technology
- opening new markets and opportunities.

Alongside the development of technology is activity to understand the barriers to the products getting to market or reaching potential users; social innovation, service design and lifestyle ethos; and interoperability and scalability.

The challenges for Assisted Living are the elements that fit together like a jigsaw:

- evidence and business case
- levers and incentives
- organisational readiness
- quality standards and interoperability
- market building
- awareness.

The next step is to deliver assisted living lifestyles at scale. The challenge is to:

- deliver innovative and cost-effective services at scale
- improve quality of life
- integrate products, services and systems to:
  - enable people to live independently for longer
  - improve quality of life
  - create a vibrant and diverse commercial landscape.
- develop communities that:
  - recognise the importance of health and well-being
  - work for individuals, families and groups
  - play a critical role in how we conceive, frame and deliver services.

The aim is to have technology available that works for people. We need to create a vibrant and diverse landscape that isn't just telehealth and telecare. Technology has to work for carers and families and we need to rethink services and how they are delivered. We need to create a culture of working together sharing both what works and what doesn't work.

The technology solutions need to be interoperable (able to work together), there is no one solution for this and all those involved in developing this technology need to work together to make a judgement on what that interoperability looks like. The Technology Strategy Board view is that interoperability should:

- lead to improved ease of use and easier installation
- have a better human factor capability;
- provide greater choice
- provide international economies of scale
- have market development enabled by lower unit costs
- above all provide improved outcomes for users.

A paper on interoperability is available at <http://bit.ly/pld516>

Successful delivery requires:

- new perspectives, skills and talents
- organisations, sectors, networks and wildcards working together
- creativity and enthusiasm
- excitement, intrigue and risk
- an environment that enables the public sector to take risks and sometimes get it wrong.

A commitment has been made for patients to be able to access their own records, which is a major cultural shift.

## Technology at the health interface

### As presented by Ailsa Claire

Acting National Director, Patient and Public Engagement, Intelligence and Insight, NHS Commissioning Board

The NHS Commissioning Board will soon oversee the commissioning of services in the NHS. One of the biggest challenges is to change the NHS so that it becomes a customer-based organisation, supporting patients to make the best decisions they can.

The channels through which the change in dynamic between the NHS and the patient can take place are:

- social media
- digital media
- building our understanding of requirements for informatics
- facilitating interoperability.

The change in dynamic will mean a move from taking away responsibility from the GP to supporting self-directed care. Patients will have responsibility for their health and direct the care they receive from the system.

A commitment has been made for patients to be able to access their own records, which is a major cultural shift. This obligation to open GP records to the patient initially met with a lot of resistance.

A user-driven service needs:

- a shared record (this records the decisions the patient and doctor make together)
- transparency (patients know what is being written about then and what is happening)
- intelligence for patients
- patient control of access technology
- maximum use of access technology (the ability to use technology to book and cancel appointments)
- maximum use of self-care technology.



The NHS Commissioning Board will provide:

- **Insight or asking patients what outcome they want.**  
In an orthopaedic study, most patients said they wouldn't have had their hip replacement they had known the outcome in advance.
- **Evidence**  
The Commissioning Board in Barnsley wanted to target men aged 45-55 as they presented late with heart problems. Initially a letter was sent inviting them to attend a clinic. It had little impact as a significant number of that group didn't have the reading age to understand the letter and most didn't want to attend to get a concern confirmed. The approach was reconfigured and staff attended the location where men were getting

together, such as the working men's club, to find out what help they needed to stop smoking. The approach changed to facilitating and supporting.

- **Requirements and expectations**  
Clinical commissioning groups won't be told how to make their decisions. There will be some national programmes, for example improving the existing Choose & Book system and the removal of financial disincentives.

The combination of pull from patients, organisational push for better care, better services and more cost-effective care and the push from the centre on expectation, standards and requirements should help us achieve this change.

The use of technology also throws up ethical issues around privacy, accountability and personal autonomy.

## Ethical issues in robot care of older people

**As presented by Professor Noel Sharkey**  
University of Sheffield

The increasing proportion of elderly in the population and concerns about quality of care, have led some to propose a robotics solution. However, this may be premature. Although robots and robotics technology could be a helpful provision within a human-centred care practice, robotics is not a panacea or a replacement for human care.

Even in an assistive role, there are still many challenges to overcome: robots are generally designed in laboratories that have lots of space to move around - but the reality of the home is quite different. It may be too small and cluttered for large robot machines. This technology is also expensive and frequently goes wrong so is not going to be in homes quickly. The use of technology also throws up ethical issues around privacy, accountability and personal autonomy.

Robotics can:

- reduce dependence which is empowering
- help older people get to social meeting places
- act as social facilitators, in the case of companion robots (although they may just be of novel value)
- reduce the need for home help (this may not be such an advantage if it removes social interaction)
- enable new care functions (if technology is fulfilling some care functions then this frees up home help to provide other valuable care to that person)
- reduce homecare staff (this is potentially a negative outcome)
- help the economy (when assessing this it will be important to take into account the running costs).

There are also a number of possible negative impacts of the use of robotics for care:

- loss of privacy
- loss of freedom
- loss of control
- reduction in human contact
- loss of dignity
- infantilisation.

Robotics can be used to assist in some care tasks but robots are not capable of care practice. We must always beware of the full automation of care and prevent a conveyor belt delivery. Humans should always be in the control loop and robots should be individually tailored to the needs of those cared for. We need to ensure that robots in care homes are for the benefit of the clients and not just for the economic benefit of the institutions.



## Conclusion: removing barriers

As reflected in audience and speaker discussions:

There is a strong case for introducing more technology into care and nursing home settings for the benefit of those who live there. There is work to be done around ethical considerations as some of those who may benefit from the technology have not had the opportunity to make decisions or choose their care plan. However, it is important that we do not lose sight of the need to spend time with older people and caring for them, as human contact is key.

The biggest challenge is to find ways to re-engineer our systems of provision. There are so many things we can do technologically but how we implement them using existing systems is challenging.

There needs to be more interaction with users in the development of products as they can give feedback that results in change in the product and subsequently much better takeup.

Better knowledge transfer about ageing and health is very important to this sector.



Will spending money on technology save money in the care of older people? Ethically, developing technology to save money is not a desirable goal. For many technologies, engineering is still very much in the research phase and we can't yet know if the end result will be of practical use.

One of the challenges to make the technology more mainstream is to overcome attitudinal problems, which in turn will help to make the technology more cost-effective. We need to see solutions driven by need and the creative process. We need to deal with stigma. There is much technology out there that could be developed to be more inclusive as people are much more amenable to adapting what they have and what they are used to.

We need to harness the expertise of technologists approaching 60 and 70 who are passionate and want to stay involved and will provide valuable expertise.

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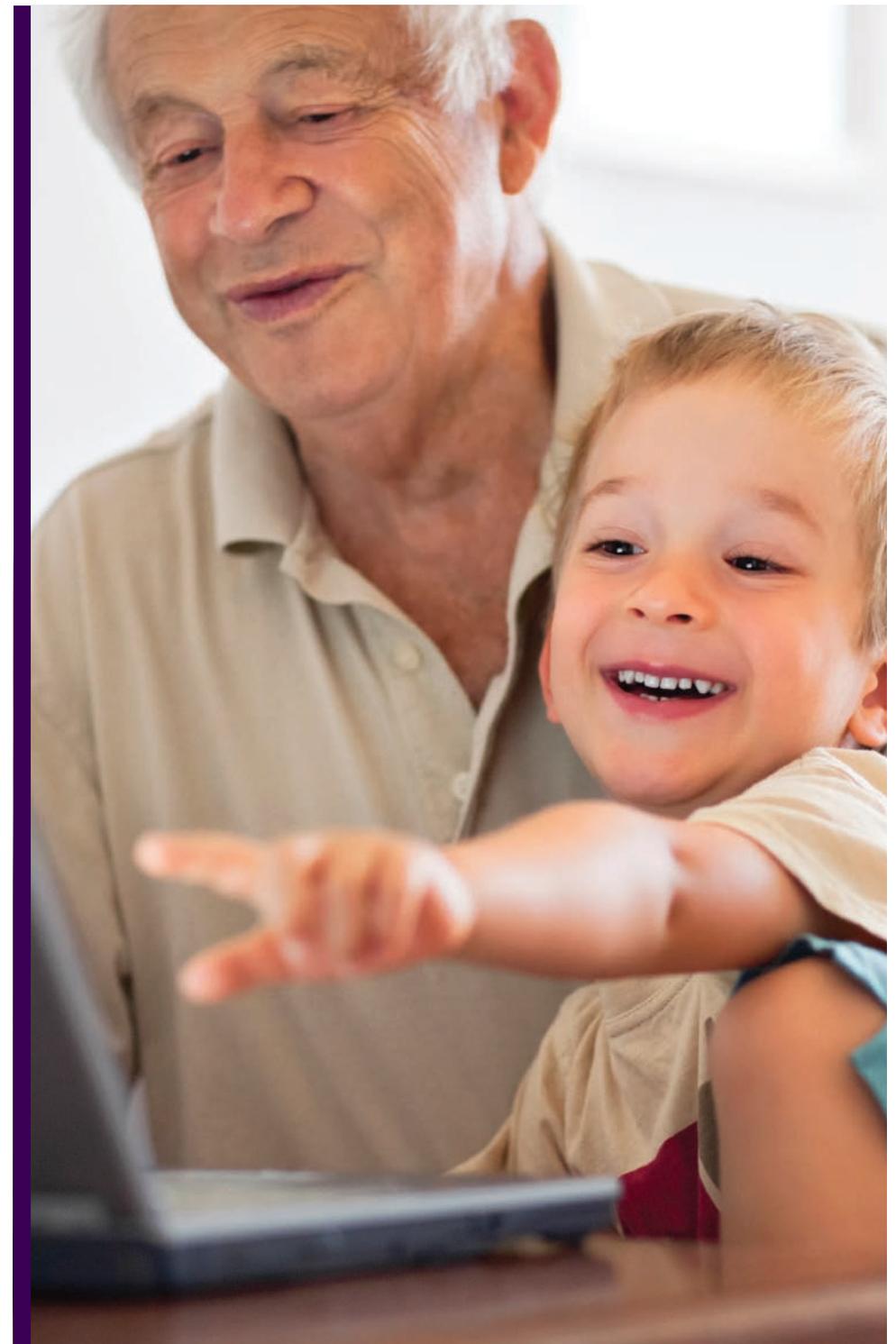
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