IET The Institution of
Engineering and Technology

Smart homes for healthier ageing

Meeting the healthy
ageing challenge through
technology and design

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1. Executive summary

The UK population is ageing rapidly; thus, new and innovative solutions are needed to address the challenges that come with this demographic shift. The Healthy Ageing Challenge was launched in 2019 as part of the government's Industrial Strategy Challenge Fund, with a £98m investment to develop new products and services that support the health and wellbeing of older adults.

This report presents case studies of four initiatives that are already making an impact in the field of healthy ageing, including innovative housing solutions, data-driven health support, technology to support people with dementia, and smart home technology for older adults. Additionally, the report offers the next steps and recommendations on how to enhance the effectiveness of these initiatives and maximise their potential to address the needs of an ageing population.
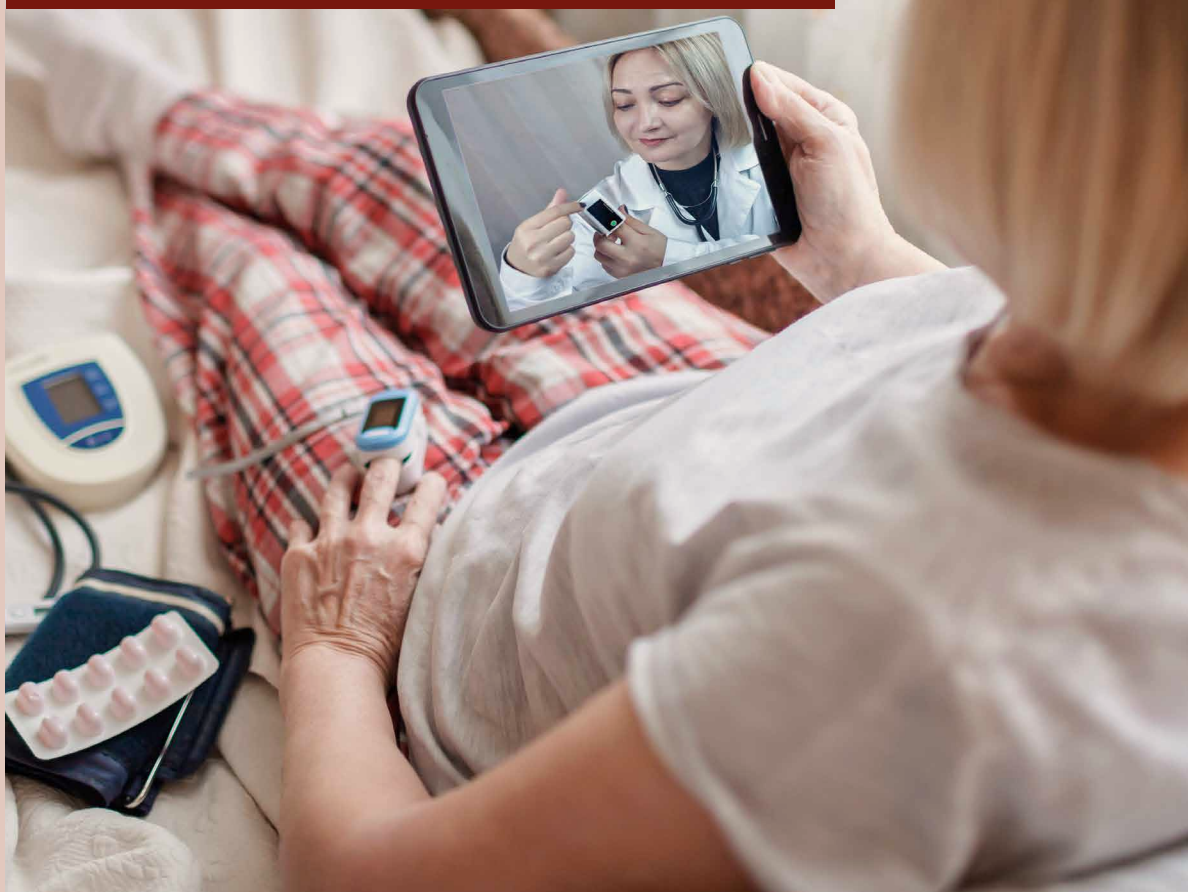
The report outlines a roadmap for the government, in collaboration with non-governmental entities, industry organisations, and academic institutions, detailing the next steps in four key areas. These areas include Innovation, Collaboration, Standards, and Education and Training.

Innovation

– Encouraging investment in research and development of relevant technologies through tax incentives, grants, or research partnerships.

– Promoting industry-wide standards for data privacy and security to increase consumer trust in IoT devices and systems.

– Offering training and support for individuals, particularly older people, and caregivers, to use relevant technologies effectively and safely.

– Developing a national campaign to raise awareness about the benefits of age-friendly technology and the importance of digital literacy for senior citizens.

Collaboration

– Establish a network of innovation hubs across the country, bringing together local authorities, technology companies, and older people to co-create and test age-friendly technologies.

– Encourage universities and colleges to incorporate ageing and technology into their curriculums, to develop the next generation of technology experts with an understanding of the needs of older adults.

– Provide training and support for local authorities and communities to engage with older people and understand their needs and preferences, in order to co-create and implement age-friendly solutions.

Standards

– Encourage and support the adoption of universal design principles in the construction of new homes, focusing on accessibility and adaptability for ageing populations.

– Establish a technical working group to review and update building codes and regulations to ensure they address the needs of older adults and those with disabilities.

– Launch an awareness campaign aimed at homeowners and landlords, highlighting the benefits of making modifications to homes to ensure they are suitable for ageing populations and those with disabilities.

– Provide incentives for building owners and developers to retrofit homes to meet the needs of older adults and those with disabilities, for example through tax credits or grants.

Education and Training

– Develop training modules and certification programs for health and social care staff on using age-friendly technologies in their work.

– Collaborate with local organisations to provide hands-on demonstrations and workshops for older adults to showcase the benefits and ease of use of various age-friendly technologies.

– Encourage technology companies to provide in-person or virtual customer support to help older adults get started with new devices and technologies.

– Work with libraries, community centres, and senior centres to host technology-focused educational events and classes.

To guarantee the effective implementation of the outlined roadmap, prioritising the next steps is essential. The focus should be on advancing the report's recommendations by:

1. Encourage co-development with older people
2. Promote knowledge sharing among stakeholders.
3. Addressing financial needs.
4. Fostering intergenerational collaboration.
5. Investing in education and training tailored for each stakeholder involved.

2. Introduction

This report highlights the important role engineers and technologists can play in supporting healthy ageing. By collaborating with older people and experts from various sectors, we can develop innovative solutions to enhance wellbeing and quality of life as people age.

Dr Sophie Taysom

There is no one-size-fits-all approach to supporting healthy ageing, but this report provides a series of responses and examples of work being done in the UK that offer valuable insights and lessons for other countries. One key element is ensuring people's homes are designed and adapted to meet their needs, incorporating technologies to support independence and safety.

Another vital aspect is the integration of health and care systems to enhance quality of life and independence. This is an area where technology can play a significant role, from remote monitoring and telemedicine to smart homes and wearables. Furthermore, we must also consider how our local environments can be redesigned to better support healthy ageing and inclusive communities.

At the core of these efforts is effective engagement with older people, as they are the ones who can provide valuable insights into their needs and preferences. Co-creation with a diverse range of older adults, from design through to implementation, can ensure solutions are tailored to the unique requirements of this population.

Through collaboration, innovation, and the use of technology, we can make significant progress towards supporting healthy ageing and enabling older people to lead full and active lives.

Over the coming decades, the proportion of people aged 65 and older is set to rise significantly[1]. This trend has implications for our health and care system, the economy, and society more generally. Supporting older people to live independent, healthy lives for longer is important for individuals, families, communities and wider society. However, existing housing, urban centres and social care provision are often poorly adapted for this purpose. Digital technologies and intelligent building design approaches available today provide a very real opportunity to meet some of these needs.

In response to the demographic pressures, the UK government has set itself a mission to ensure citizens can enjoy at least five extra healthy, independent years of life by 2035, while narrowing the gap between the experience of the richest and poorest in society.[2] One of the innovation missions under the UK's Industrial Strategy Grand Challenge, the "Healthy Ageing Challenge" aims to improve people's lives, boost productivity and put the UK at the forefront of future growth industries. It has a £98 million investment fund.

[1]   https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816458/future-of-an-ageing-population.pdf
[2]   https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions#healthy-lives;

3. The healthy ageing challenge

Investment in Research and Development to create environments that promote healthy living among older people under the UK's national innovation strategy has been given added impetus by the Covid-19 pandemic, which disproportionately affected people aged 65 and over.

1 **How are homes and neighbourhoods being adapted under the healthy ageing challenge?**

"Age-friendly homes and healthy active places" is one of seven themes in the challenge.[3] The £40 million Trailblazer programme fosters cutting-edge innovation, while the £39 million Investment Accelerator partners with private investors to help businesses develop new products and services. The £9.5 million Social, Behavioural and Design Research Programme (SBDRP) sponsors interdisciplinary teams to carry out research into healthy ageing. Initiatives include a *Home of 2030* competition to design "homes of the future"; a joint UK-Japan competition to develop new assisted living products; and Trailblazer projects to forge a new type of community for people with dementia; and to help older people improve their homes.

2 **How can digital technology be deployed to improve health services for older people?**

Remote diagnosis and health monitoring are growth areas for digital innovation. The Covid-19 pandemic has accelerated the trend, with initiatives in progress across fields spanning clinical appointments, population health, operating systems for care workers, and remote monitoring in homes and in care homes. Improving coordination between care homes and health providers is a key focus. Trials include a remote system for reporting the Covid-19 status of care home residents in Manchester;[4] and use of the WHZAN Blue Box and NEWS2 vital signs monitoring system to assess deterioration among elderly people in residential homes across East Anglia.[5] Developments in this area also need be take into consideration alongside views and concerns about privacy and security.[6]

3 **How can the internet of things be used to enable older people to live independently in their own homes for longer and reduce isolation?**

The race is on to develop the smartest home automation systems using the internet of things, with Google, Amazon, Microsoft and Samsung all active in the market. The field spans virtual assistants, control hubs, wearables and smart displays. A key segment is technologies that support independent living, combining home systems designed around the needs of older people with connected health and remote monitoring features. Amazon's Alexa Together subscription service, announced in September 2021, is a front-runner in this space.[7] It provides hands-free access to an emergency hotline, and can send alerts to family members and carers, who are also able to set reminders and manage daily tasks remotely.

4 **How can technology and intelligent design put healthy living at the heart of supported communities for older people?**

High design standards for factors such as air quality, light & temperature control and careful screening of building materials for health effects are necessary to ensure comfort and safety in the home.[8] This is especially important in care settings. Good design also provides for natural lighting, views of communal gardens, and access to social, recreational and outdoor spaces.[9] Wireless connectivity and control systems can equip residents with smart-home tech to support independent living within their accommodation, connect them to family and friends, and provide access to care when needed. Older people living in communities with exercise, activity, and social programmes have reduced dependence on medical services.[10]

[3] https://www.ukri.org/our-work/our-main-funds/industrial-strategy-challenge-fund/ageing-society/healthy-ageing-challenge/;
https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions#healthy-lives
[4] https://healthinnovationmanchester.com/our-work/digital-care-homes/
[5] https://www.easternahsn.org/telehealth-remote-monitoring-in-care-homes/
[6] https://www.usenix.org/system/files/soups2019-frik.pdf
[7] https://www.digitaltrends.com/home/amazon-alexa-together-aging-in-place/
[8] https://www.cibse.org/Knowledge/CIBSE-TM/TM40-2019-Health-Issues-and-Wellbeing-in-Building-Services
[9] https://www.housinglin.org.uk/Topics/ECHScheme/search/St-Loyes/
[10] https://www.extracare.org.uk/newsroom/news/extracare-opens-new-56m-retirement-village-in-stoke-gifford-today/

4. Shaping a brighter future for later life

New and improved lifestyle options for older people are being created through pioneering initiatives already in progress. Momentum will gather as further projects to design age-friendly homes and technology are launched under the Healthy Ageing Challenge. A strong focus on user experience is a key feature of successful projects.

1 Five regions to lead drive for age-friendly homes
Innovators will trial new housing solutions in testbed areas

Connected Places Catapult launched the Homes for Healthy Ageing program in August 2021 with a £2.5 million Research and Development fund aimed at developing new homes to support the health and wellbeing of the UK's ageing population. The program brings together local authorities, housing associations, and businesses to develop innovative solutions for housing challenges faced by older adults. The program established five "testbed" areas in Northern Ireland, Sunderland, Leeds, Brighton, and Essex where selected innovators will trial their projects with hands-on support and access to the latest innovations from UK businesses.

The first two testbed areas in Northern Ireland and Sunderland received £50,000 each towards a taskforce to manage the program. In the late summer of 2021,

an open call for innovative solutions was issued for the two areas and bids for three further testbeds were submitted by the end of October 2021.

Real-world testing, the approach taken by the Homes for Healthy Ageing program, enables stakeholders to test and showcase new or existing products and services in a real-world setting to understand their impact and gather evidence. Connected Places Catapult provides support with defining local healthy ageing challenges, connecting stakeholders with appropriate solutions, creating safe testing environments, and measuring the impact.

As of February 2023, the Homes for Healthy Ageing program is ongoing and continues to demonstrate the impact of a collaborative and innovative approach to delivering homes and neighbourhoods that support the health and wellbeing of older adults and enable them to thrive.

2 Manchester spearheads healthy ageing data hub
AI-based system aims to pinpoint health needs

An information hub to support healthy ageing is being developed in Manchester under a Trailblazer programme. This is backed by £2 million from the Industrial Strategy Challenge Fund.[11]

The project is a collaboration between Philips Electronics and eight partners including Manchester City Council, Microsoft, Cisco International, the Design Council, and the University of Manchester.
The digital system takes a "value-based" approach to health and care. It aims to raise quality standards and drive efficiency by focusing on patient preferences and health outcomes.

The system uses artificial intelligence (AI) to analyse population health data for Greater Manchester. This is then linked to information on housing design; measurements of health outcomes; and the results of outreach, citizen engagement, health monitoring, and risk-stratification exercises.

The prototype aims to identify the health needs of older people through monitoring and engagement exercises; identify those in need of early intervention through data analysis; and drive effectiveness in health and care provision through continuous measuring of outcomes.[12]

The project is also establishing a new agency for age-friendly design that will offer advice on adapting homes and neighbourhoods to meet the needs of older people with products and services that promote social connection, physical activity and quality of life.

3 Smart solution for living with dementia
Age-tech enables patients to live independently

Cutting-edge technology is combined with user-centred design in the UK's first model smart home for people with dementia.

The Gloucester Smart House showcases a system that enables people with dementia to live in their own homes with minimal support, maintaining independence and quality of life.[13]

It was jointly developed by Bath Institute of Medical Engineering (BIME), the charity Dementia Voice and housing association Housing 21, from an ordinary three-bedroom house in a sheltered housing complex.[14]

The smart home uses wireless sensors, voice reminders, beepers, and simplified user interfaces to help people with dementia cope with everyday tasks and to avert potential hazards without calling in care staff.

If the resident gets up at night, bed and movement sensors will switch on the lights, and so help prevent falls. If they lose their keys or purse, pressing a picture on a wall panel will activate a beeper that can lead them to the missing object.

The devices are linked to a European Installation Bus (EIB) control system.

[10] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/897922/Competition_Results_-_ISCF_Healthy_Ageing_Trailblazers_-_Stage_1.pdf
[11] https://www.weforum.org/agenda/2019/02/here-s-how-to-make-value-based-healthcare-a-reality/
[12] https://www.academia.edu/1815927/Taking_the_Gloucester_Smart_House_from_the_laboratory_to_the_living_room
[13] http://news.bbc.co.uk/1/hi/health/799128.stm

4 Covid-19 boosts tech uptake in ExtraCare village
Residents sample age-tech at innovation apartment

An innovation apartment has been set up within a £56 million retirement village outside Bristol to demonstrate smart devices for active ageing to residents.[15]

The facility at Stoke Gifford ExtraCare Village showcases gadgetry, including sensors, smart speakers, voice-activated assistants, a video doorbell, and a wireless home system that links residents to care staff and controls heating, blinds, appliances, memory aids and security.

It was developed under a two-year Knowledge Transfer Partnership with experts at the University of the West of England, who helped test and trial the technology and are gathering data on how residents interact with the systems.[16]

The retirement village, which aims to help older people lead independent, healthy lives, also runs a regular smart market, where residents can borrow gadgets for a period of time to try out in their own apartments.

The Covid-19 pandemic and lockdowns accelerated the adoption of smart home tech within the 261-apartment village, with the ExtraCare Charitable Trust stepping up connectivity and remote services to ensure safe access to care and combat isolation.

Redgear sensors were installed in residents' apartments to monitor temperature, humidity and movement patterns, and online dance and exercise classes were offered along with IT skills training.

"I want to see a range of choices about where people live and grow older. For myself, what I really want is personalised care driven by the power of technology: a well-designed smart, small home with sensors and a virtual personal assistant. Yes, I would like a social robot. And along with that, I want access to driverless cars and to live in a multi-generational community."

Shirley Ayres, author of *The Click Guide to Ageing Well*.[17]

[15] https://www.extracare.org.uk/newsroom/news/extracare-opens-new-56m-retirement-village-in-stoke-gifford-today/
[16] https://blogs.uwe.ac.uk/research-business-innovation/knowledge-transfer-partnership-with-extracare-introduces-assistive-technologies-to-retirement-villages/
[17] http://clickguide.co.uk/ageing/ageing.php

5. The next steps

Innovation

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– Promoting industry-wide standards for data privacy and security to increase consumer trust in IoT devices and systems.

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– Provide training and support for local authorities and communities to engage with older people and understand their needs and preferences, in order to co-create and implement age-friendly solutions.

Standards

– Encourage and support the adoption of universal design principles in the construction of new homes, focusing on accessibility and adaptability for ageing populations.

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6. We say…

The UK's ageing population presents significant challenges for the government, which makes it imperative to fund innovation through the £98 million Healthy Ageing Challenge. However, this funding is only the first step in addressing the challenges arising from the ageing population. To ensure the successful implementation of the programme, careful planning and urgency are essential.

Given the vital role technology plays in supporting the health and wellbeing of older people, we recommend the government prioritise technology innovation in its policy planning. To this end, we suggest five specific recommendations the government should consider.

1 Encourage Co-Development with Older People

To ensure technology has a positive impact on supporting healthy ageing, the government should prioritise the engagement of older people from the outset of any initiatives. By doing so, the government can ensure technological solutions are designed with older people in mind.

2 Promote Knowledge Sharing

To optimise the advantages of engineering and innovation, it is recommended the government promote a culture of open and transparent knowledge sharing among stakeholders. By doing so, it can minimise the redundancy of effort and enhance the adoption and impact of novel technological solutions.

3 Address Financing Needs

The government should explore a range of financing options, including grants, tax incentives, and other forms of support to help support ageing in place and age-friendly housing initiatives. By doing so, the government can ensure these initiatives are accessible and sustainable over the long term.

4 Foster Intergenerational Collaboration

To drive innovation and development in the field of age-friendly technologies, it is recommended that the government promotes partnerships between older people, health and technology companies, academics, and local government. This collaborative approach can leverage the expertise of various stakeholders to create effective technological solutions to support healthy ageing.

5 Invest in Education and Training

The government should invest in education and training for health and social care staff, older people, and the public to raise awareness of the potential of age-friendly technologies and their impact on healthy ageing. This can include information campaigns, community engagement initiatives, and digital literacy training.
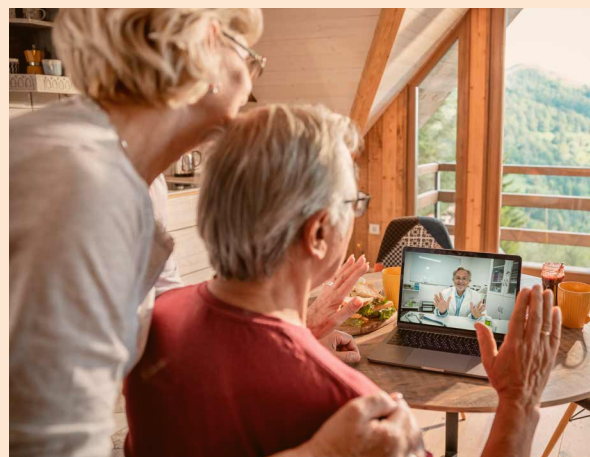
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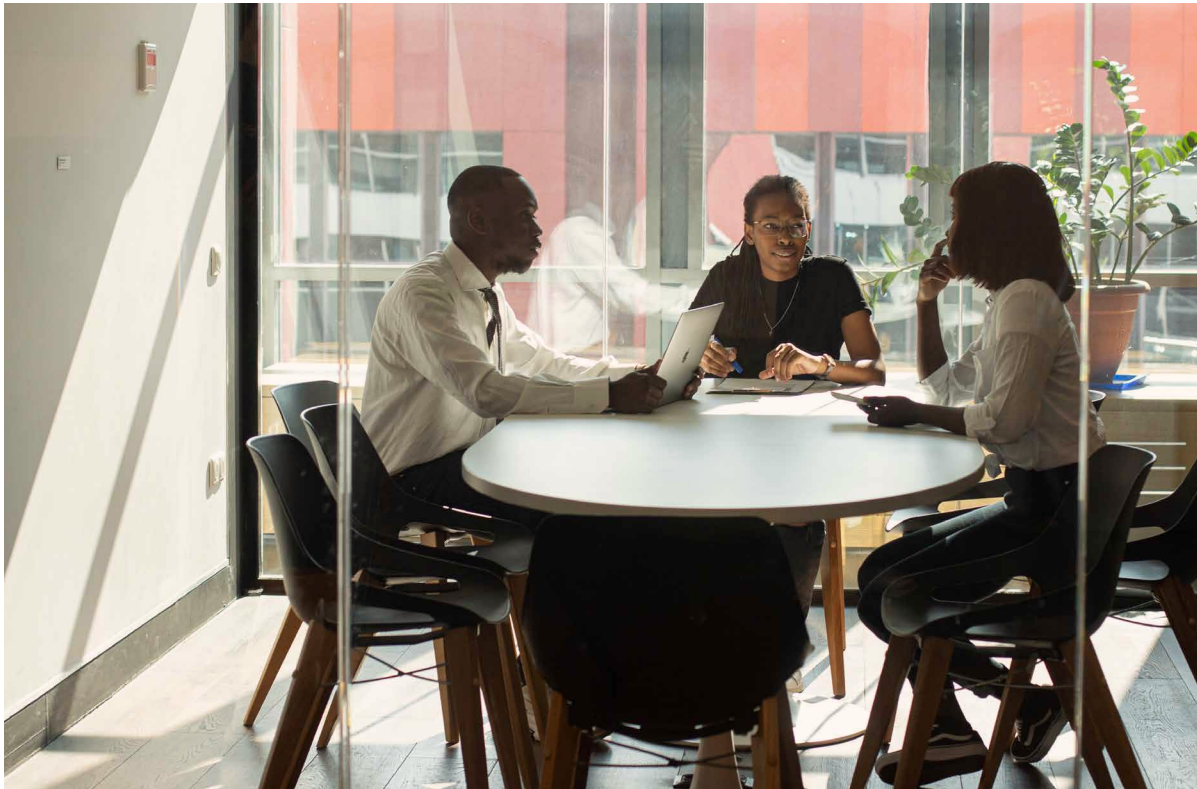
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