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My healthy future: healthy ageing workshop

In 2018, the PHG Foundation held four life stage workshops to inform *My healthy future*, focusing on the future of healthcare in 20 years' time. At this workshop, experts met to discuss how new technologies are shaping the health of older people, and the impact this may have on citizens, health systems and wider society.

Potential of technology

The discussion surrounding the potential healthcare benefits generated by new technologies centred around the following main areas:

1. The overall approach to the development of technologies

2. Advances in biomedical science and the use of big data

3. Technologies that would increase understanding of individual risk, detection and management of early disease

4. Technologies to promote better health, including to promote social interaction

5. Technologies to help us understand and mitigate against differential access by different groups in society

Overall approach

It was envisaged that technologies would be increasingly integrated into daily living and into healthcare. Delegates felt that it was important that technological development be driven by principles designed by society, rather than allowing the technologies themselves to drive behaviour. Important principles included that:

- Technologies should take into account individual values, recognising that different people are driven by different motivating values such as self-direction, achievement, security, benevolence

- Technology developments should be harnessed to support the way we wish to live

- User experience should be embedded in development. This will require further development of participative methodologies

> The focus of this workshop was on 'healthy ageing' and how the healthcare landscape might develop in 20 years' time.

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Advances in biomedical science

Important advances in the following fields were identified:

- Early genomic identification of at-risk individuals

- Better understanding of drugs from dietary compounds that would increase robustness during life

- Targeting senescent cells through treatments

- Advances in the range and accuracy of sensors, including wearables and environmental sensors ('smart homes')

- More sophisticated apps, 'bots' and use of AI

- Better treatments using improved biomaterials, robotics, exo-skeletons and regenerative medicine

Fundamental to the optimal use of most technologies identified would be improvements in the ability to collect, harness and use big data.

Individual risk, detection and management of very early disease

In the future, much more information will be available from a wide variety of sources about individuals, their risk of disease and current health. As they age it may be possible to pick up signs of very early disease, (enabling timely intervention) or to put in place interventions that can slow down disease progression or mitigate its effects, enabling the older person to maintain wellbeing. There will likely be better and more widely available bioassays to detect biomarkers indicative of ill-health informed by genetic information which will be more readily available. Indeed, this could be obtained proactively through routine neonatal whole genome sequencing, and could then inform healthy behaviours and interventions over a lifetime. Data would also be collected from a range of smaller and less intrusive sensors and monitors, and through daily living activities. All of this data would need to be integrated and aggregated from a variety of sources.

Some examples of new sensors and the way in which they may be used to predict disease and patterns of health events include:

General indications of early health problems may be predicted through sensors that perform speech analysis, gait analysis, sit to stand analysis, and monitor how you use your keyboard
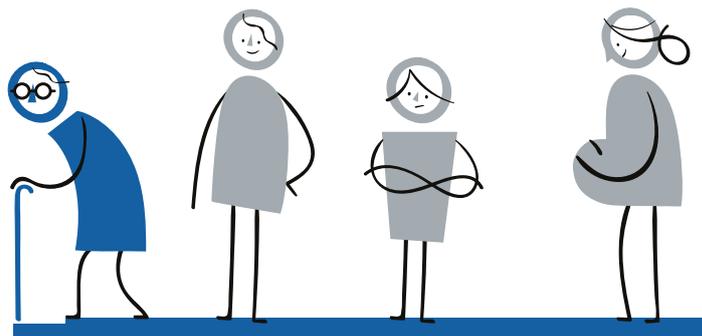
Sensors for **pre-dementia diagnosis** may detect 'slowing down' through the way in which individuals interact with their environment. Smart homes could be developed that respond in ways that train the individual once cognitive decline has been identified. For example, there may be environmental sensors that can detect that an individual is forgetful in a particular area, and instigate an active response and reaction, training the individual, providing prompts, suggesting behaviour change or automatically modifying their environment. This might happen from age 50 to 60 years so that people are trained by their environment in ways that will prepare them for their own, particular 'older life'.

Physical activity - wearable technology will evolve beyond merely measuring basic activity levels/number of steps to include posture and all aspects of mobility, accurately assessing physical activity and measuring the speed at which older people do such things. The information would then be used to generate automated personalised feedback and to monitor adherence. The data and personalised feedback would be used to improve physical movements and could be centrally collected and communicated to others, including being shared with a carer or family member.

As older people begin to experience multi-morbidity, integrated behavioural and genetic data could be used to monitor drug prescriptions for potential complex drug interaction. It is hoped that this will lead to a reduction in poly-pharmacy and fewer instances of adverse events arising from drug use in such patients.
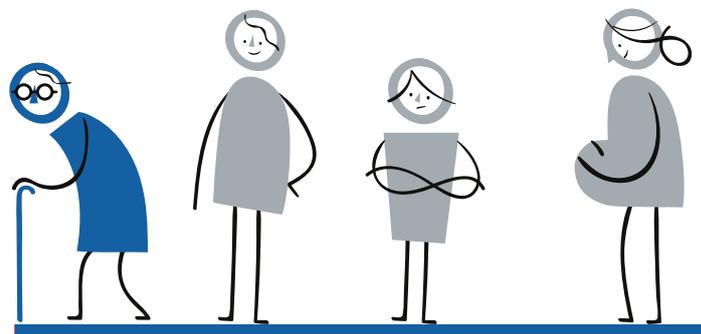
Technologies to promote better health in older people

Delegates discussed the potential for new technologies to (i) inform older people about behaviours that may be linked to ill health and to promote 'good' behaviours throughout life, and (ii) promote wider inclusion within society, which could impact upon wellbeing.

Technologies suggested included:

For the individual:

- **Life story work:** collecting lifelong data that is highly personalised could help people learn from their life stories

- **Gamification** involves the incorporation of game-design elements and principles into non-game contexts with the aim of making them less tedious and more desirable. Important features would include:

  - Use of lay language with simple methods to interact

  - The provision of rewards and feedback

  - Empowerment of individuals through personal information

  - The ability to track usage

- **Promoting inclusion through improved communication.** Technologies should be available in people's homes to enable them to get out and interact with others

- **Harnessing social media for wellbeing.** Reduction in social isolation is important for wellbeing and mental health

Whether in the context of staying healthy, understanding risk, consulting health professionals, or health management, it is envisaged that new technologies will enable individuals to access and experience health interventions that are increasingly personalised to their individual needs. Examples suggested include:

- **The 'life assistant'.** Virtual life assistants designed for healthcare might present a machine learning approach to early detection/management of chronic disease. The assistant would have an understanding of the individual, their circumstances and behaviours, and would respond with advice and prompts reinforced by knowledge of the local environment and opportunities available. A life assistant might suggest local activities if an individual is more sedentary than normal, or detect when an individual is unwell and actively encourage behaviour change

- **Virtual consultations.** It was anticipated that there would be E-clinics and sensors to improve access and provide additional options for care to those who may be unable or prefer not to attend a face-to-face consultation

- **Bots to deliver interventions.** The example was given of mental health chatbots that can improve resilience through delivering coping mechanisms or cognitive behavioural therapy

Technologies to help us understand and mitigate against differences in access

Evidence suggests that there is inequality of access to personalised healthcare technologies. Wider technologies and big data can be used to identify which groups are having difficulty in access, and design solutions to this problem, such as purposively targeting those with reduced resources. For example, it may be necessary to design interventions for individuals living in communities with poorer infrastructure and fewer resources. We will be able to use data to understand the parameters important in accessing technologies in healthcare and to fine-tune the interventions for these more marginalised groups and individuals.

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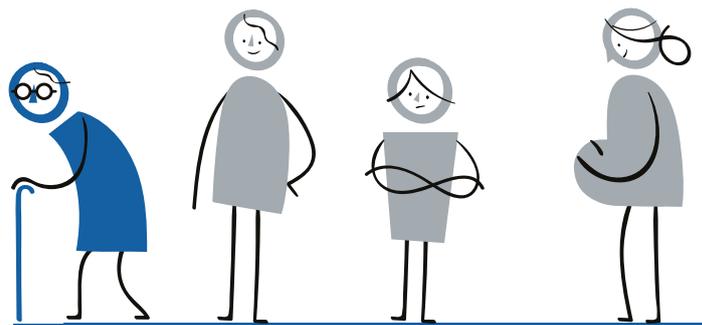
What issues will arise as these technologies are brought into play?

Issues discussed were grouped into the following main themes:

1.   System – social and individual rules

2.   Proportionate evidence

3.   Multiple barriers to implementation

4.   Unintended individual consequences

5.   Unintended social consequences

System – social and individual rules

A set of themes arose around the social rules, values and assumptions within which technologies are being developed, supposedly to improve the health of older people. It is important to be mindful of what the technologies are for and the potential positive and negative uses of them. Technologies could be used to help empower, support and enable people to achieve what they want for themselves or they could be used as a way to undermine privacy, control people and impose values. Technologies can be harnessed to effect social change, but it is vital that the underlying value systems are explicit.

Drivers for technological development

An accompanying theme was the need to understand what is driving and shaping the development of particular technologies. In the case of older people, concern was expressed that research and technology development are shaped by societal expectations and understanding surrounding what is 'normal' ageing versus what is pathological – or caused by disease. This tendency leads to a degree of fatalism about what is seen as the natural consequences of ageing which may hamper the progression of research, even though decline in both instances is underpinned by the same biological mechanisms.

Concerns about drivers included the following

Is innovation being driven by need? Will the wellbeing of people be improved by the technologies identified – are they aligned with the challenges faced, such as whether there are sufficient resources to sustain improvements over time?

■   **The assumption that evidence is driving innovation -** whereas often the process is one where a market is sought for a new technology.

■   **Hype -** there is a danger that big promises drive much of the research.

Designing technologies for older people

Designing technologies with the end users in mind would be important for this older population and here the heterogeneity of older people must be understood. On the one hand, participants noted the 'tyranny of low expectations' where older people were thought of as being multi-morbid and with physical impairments limiting their abilities. On the other hand, focusing on capabilities and what older people can do, might be harmful for those who lack sufficient capabilities which can then be blamed for their failure to help themselves.

Ethical, legal and social concerns

Harnessing the potential of new technologies relies on the collection and amalgamation of information generated through multiple sources including 'digital personal assistants', a wide range of sensors and digitally enabled support systems. In order to derive useful insights, the data collected needs to be shared with others and often, placed in large databases where it can be pooled to develop new interventions and ongoing learning about patient management.

Concerns centred on:

- **Loss of privacy** - Individuals might feel that they are 'being watched' ostensibly for the provision of support

- **Data sharing** – In order to maximise the utility of this data it needs to be shared, which relies upon sufficient infrastructure being in place, but also upon public trust and acceptability

- **Liability** - Who is liable for errors made by technologies?

Loss of person centred healthcare

There was concern that increasing technology would depersonalise healthcare by reducing a person to their data. In general it was thought that more time spent 'ticking boxes' would go against person centred healthcare and reduce the complexity necessary to understand an individual to a 'dumbed down' dataset. Where systems rely on such technology, particularly where this replaces knowledgeable individuals, there would be reduced flexibility in the nature and timing of the interventions provided and there was a danger that clinical practice would be depersonalised and 'taken backwards'.

Proportionate evidence

Gaining and using evidence to make decisions on new technologies that might improve health for older people through personalised prevention can be problematic.

- Evidence must be developed specifically for this age group and requires an understanding of what is 'good' for the generation of older people whilst recognising that this demographic is, itself, heterogeneous
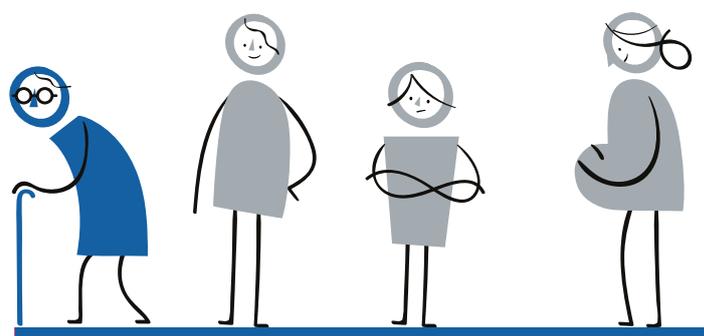
- Research on outcomes should be based on an understanding of the basic human needs to be met

- The processes of translation and implementation of evidence into routine practice are not helpful. There were concerns about premature implementation before there is evidence of utility and, conversely, the need to keep up with rapidly advancing technology and to implement without too many delays

- New methods may be needed for evaluation to take account of individual responses to interventions

Multiple barriers to implementation

There are many barriers to implementation, particularly in a large organisation such as the NHS. Barriers can be grouped under mechanisms and rules for decision-making on innovation and organisational culture.

Mechanisms and rules

With limited resources there is a question of how we prioritise interventions. In addition to the many questions over evaluation, there is a perception that the NHS is risk averse in taking on new technologies. It was suggested that the requirement for increased proof meant that uptake became very slow and that the NHS would never have enough evidence to adopt technologies in a timely manner. This problem was further exacerbated by the need for uptake to be achieved system wide.

Organisational culture

Given that the NHS is described as being slow to implement new technologies, it is thus important that technologies are developed and marketed to health service providers in terms that will motivate individual health professionals as- 'something that will be beneficial to them'. Overall, there is a need to shift organisational culture to adopt change. However, there are also a number of practical requirements: health professionals need to learn how to use and integrate these new technologies into their practice and may need to 'relearn' some aspects of clinical care.

Unintended individual consequences

The development and use of technologies in the context of various aspects of healthy ageing is dependent on understanding how individuals will embrace this and the effects it may have.

As people gain knowledge surrounding their personal risk they could become more isolated. In particular, as our understanding of disease becomes more fine-tuned, the number of people with a particular condition will be smaller, meaning that it is important to build the technologies for these individuals to find others with a similar condition.
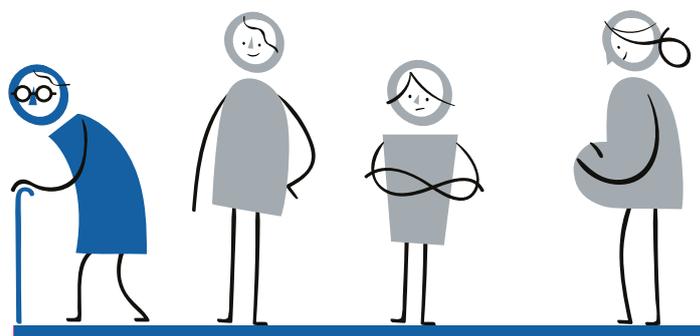
The group also voiced the concern that society may become more preoccupied with health and that individuals may become more medicalised. This may result from commercialisation – the marketing of new technologies and promotion of individualism. However it was important that technology should enhance the ability to live life without being wholly preoccupied with health.

Unintended social consequences

Technologies may contribute to the extending lifespan of human beings. It was suggested that many people born after the year 2000 will live until aged 100. It was acknowledged that the changing demographics of the population would require substantial societal restructuring.

Stigmatisation of ageing

The development of technologies specifically to assist older people to stay healthy runs the risk of stigmatising this population group. We could view ageing as a natural process, in which case the development of technologies and applications specifically for this age group may, in itself, be stigmatising. This effect on the population may be magnified by technologies using inaccessible language, setting unrealistic standards or becoming a controlling force.

Widening of inequalities in an individualistic society

Technologies to improve the health of older people through personalised prevention need to be appropriate and fulfil the needs of all groups in society. Access to new technologies should be based on need and not restricted by financial or other social barriers, otherwise there will be exacerbations of health inequalities. However, two main factors were described as contributing to inequality rather than mitigating it:

■ The tendency for researchers 'to think of elderly people as older versions of themselves – which usually means educated, middle class people who have a nice life and for whom things are relatively easy.' The technologies should, in broad terms, be accessible to all stakeholders, although, for individual technologies it must be recognised that it may be necessary to target certain groups, such as lower socioeconomic groups or those with other concerns.

■ The need to address social inequality directly in designing and providing new interventions. Developments in personalised prevention must acknowledge that people's experience is shaped by their community. In some communities a sense of fatalism and inability to enact change starts at a young age; people in low socioeconomic groups have limitations put on them from birth which are then difficult to overcome with age. It is thus unhelpful that technologies are often designed by people who have not experienced life in the communities where this sense of fatalism exists and who have more than average resources.

> There are many barriers to implementation, particularly in a large organisation such as the NHS

What will be the desirable objectives and/or priorities for the future?

Participants were assigned to small working groups and asked to make recommendations about what needs to change to address the issues and concerns voiced in the previous session.

General principles

Purposeful leadership is needed in this area. Policymakers and researchers have a role in leadership but it would also be important to include those heading the industrial strategy (reflecting commercial interests).

Ethical, legal and regulatory landscape

It is important to understand the current impact on health and well-being of existing regulation and governance as well as some of the consequences when mistakes are made. Specific examples included:

- The regulation of data processing by the EU General Data Protection Regulation and Data Protection Act 2018

- The approaches to assigning liability and risk tolerance

- Professional or community based means of dealing with regulatory issues and breaches (including relevant professional guidance)

Proportionate evidence

This addressed the important question of how we gather and then implement the necessary evidence to enable us to build effective technologies for society.

- The general research approach should be interdisciplinary and will require flexible methodologies

- General principles for research should be set out by a stakeholder group including research funders, academics, professionals, people involved in public health and others as relevant

- There is a need to be neutral in the way we research and evaluate new technologies and not assume they will be either bad or beneficial
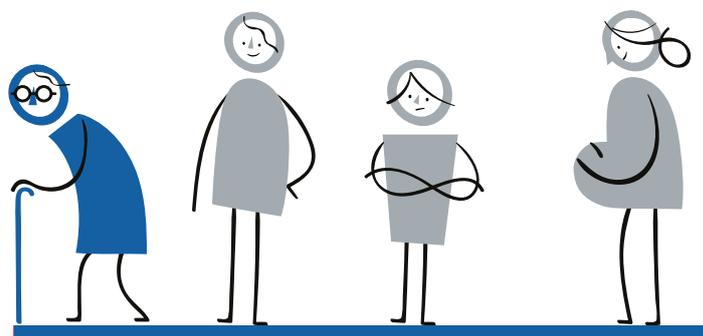
- It is important to build health into rapid prototyping

- Research is often done in closed settings, meaning real life trials are needed

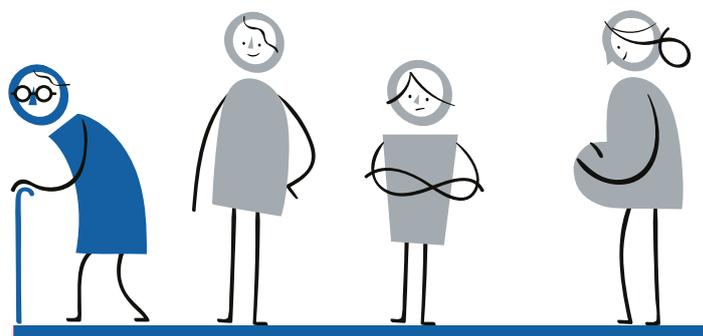## Unintended individual consequences

Important aspects to address included the following:

- **Changing the social perceptions of ageing** – to reduce the fatalism associated with the aging process

- **Lifetime planning**, from an early age, is very important

- **Taking a holistic approach** which incorporates all aspects of an individual, rather than focusing on particular elements

- **Ensuring personal choice** by focusing on the individual, understanding their desires, concerns and circumstances

- **Linking personal choice to the idea of responsibility** – whilst there are some who have the resources and capabilities to take responsibility for their health, for the majority who lack the resources, knowledge and capabilities, this expectation may be unreasonable and unfair

Unintended social consequences

Discussion focused on the potential for inequalities to be increased:

- Equality of access should be included as a consideration at the pre-design stage for a new technology and then throughout the process to implementation

- Approaches for technological development and to maximise uptake need to be targeted, aiming for inclusiveness but recognising that one approach will not meet everyone's needs

- Approaches for technology development must be appropriate for different educational levels, cultural and language needs, and sensory, cognitive and physical needs

- It will be important to evaluate the impact of specific interventions, and combinations of interventions to identify when this has generated further inequality. This may require development of new methodologies

My healthy future healthy ageing workshop participants

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PHG Foundation is a health policy think tank with a special focus on how genomics and other emerging health technologies can provide more effective, personalised healthcare