

# Delivering prevention in an ageing world

Using technology effectively

Technology  
Prevention  
Health and care  
Immunisation  
Inequalities  
Diseases and conditions  
Life expectancy  
International

Consultation paper

## Acknowledgements

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**Author:** Arunima Himawan

## Executive summary

The world has seen huge technological advances over the last couple of decades, from wearable technologies to artificial intelligence. And in the last year we've seen countries respond to the COVID-19 pandemic by hurriedly turning to technological solutions without carefully considering their implications or impact.

There's a risk that technology will come to be seen as a simple tool which will solve our biggest health challenges, including the ones associated with prevention. But the reality is that high-tech solutions have often over-promised and under-delivered. The problem isn't a lack of innovation but the challenges of implementing solutions and ensuring that they benefit everyone equally.

Through conversations with stakeholders over the last two years we've identified that technology can help deliver prevention by:

1. **Improving population health** through the use of big data to develop targeted preventative health strategies and improve health outcomes
2. **Supporting healthcare delivery** by providing electronic health record systems and a wide range of online health services to deliver better and more efficient preventative advice and care throughout our lives
3. **Connecting individuals to preventative healthcare** by overcoming distance barriers and enabling them to live independently for longer
4. **Empowering individuals** to take control of their health, and improve their health and wellbeing by supporting their health literacy.

But we know there are still challenges to ensuring technology's potential is fully maximised across these four areas.

As part of the conversation we wish to continue, we have specific questions for you on how we can use technology most effectively. The most important are:

### **How can we maximise the potential of technology?**

- How else can technology be used, both within and beyond the healthcare system, to help deliver prevention?
- Who do we need to influence to maximise the potential of technology in delivering preventative healthcare?

### **How can we tackle the barriers to using technology effectively?**

- How can we tackle the digital divide and ensure technology doesn't exacerbate or create new health inequalities? What examples of good practice can we learn from?
- How can we address data privacy and misuse concerns? How can we give individuals greater control over their data?
- How do we deliver interoperability?

### **How do we measure success?**

- How can we ensure health technologies are successful when implemented? How can we ensure that they actually deliver their potential?
- How can we measure whether a technological health intervention is cost-effective? And how can we get better at measuring cost-effectiveness?

We'd also like to hear from you if you think there's anything we've missed:

- What other mechanisms and levers are important in ensuring technology can help support preventative health efforts?
- Can you share other examples of health interventions that work, are cost-effective, and help to minimise the digital divide and reduce health inequalities?

We invite your thoughts and feedback. You can respond to the consultation **here** until Wednesday, 30 June 2021. Thank you for your help – it's vital to our programme.

## We want to hear from you

The International Longevity Centre (ILC) is running *Delivering prevention in an ageing world*, an international programme of work supported by Home Instead Senior Care, GSK, Pfizer, Seqirus, MSD, and Gilead. Our aim is to discover how G20 countries can deliver preventative healthcare throughout people's lives.

Following *Prevention in an ageing world*, a year-long programme that sparked conversations in Abu Dhabi, Taipei, Austin, Geneva, Sydney and London that reached all the way to the G20 Health Ministers, the message is clear: it's never too late to prevent. And the health and economic costs of failing to invest in preventative interventions across the life course are simply too high to ignore.

We're reaching out to stakeholders around the globe to understand not only **why** we should prioritise prevention, but **how** we can deliver it.

The *Delivering prevention in an ageing world* programme reflects the urgent need for G20 governments to match commitment with action, by:

- **Democratising access to prevention** to reduce health inequalities
- **Inspiring and engaging with policymakers, healthcare professionals and individuals** to invest, promote and take action on prevention
- **Using technology effectively** to improve access to preventative healthcare, improve uptake rates, reduce barriers, and empower patients

This consultation paper is the third and final publication that aims to engage with health and policy experts on ways to deliver prevention.<sup>1</sup> Our paper lists the key areas we've identified where technology can play a crucial role in helping push forward the prevention agenda. Our upcoming expert roundtable will be an opportunity for you to respond.

But the conversation mustn't end there. We want to engage with as many experts as possible during our consultation process. We want to know what other mechanisms and levers are important in ensuring technology can help support the delivery of preventative health interventions. We want to know how else we can overcome the digital divide and reduce inequalities in health. And we'd like to find more examples of good practice from G20 countries.

You can respond to the consultation **here** until Wednesday, 30 June 2021. Thank you for your help – it's vital to our programme.

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## Delivering prevention in an ageing world

Across the G20, people are living longer, but not necessarily healthier, lives. We know that, left unchecked, the situation will get worse. Investing in prevention is central to addressing this challenge. We know that:

- Prevention works: it substantially improves society's health and wellbeing by reducing morbidity and increasing the number of years spent in good health:
  - The global disease burden could reduce by 40% over the next 20 years with preventative health interventions<sup>2</sup>
  - There's a positive relationship between investing more in public health spending and increasing healthy life expectancy<sup>3</sup>
- Prevention is cost-effective: it provides value for money and returns on investment in both the short- and long-term, and contributes to the sustainability of our healthcare systems:
  - Immunisation, screening programmes, and health checks are known to be both cost-effective and cost-saving<sup>5</sup>
  - Access to, and proper use of, medications not only improves population health but also reduces unnecessary economic burdens on healthcare systems<sup>6</sup>
- The benefits of prevention extend beyond healthcare systems; it also benefits economies by helping people continue to work and spend in later life:
  - In Europe, people who report being in good rather than poor health are over four times more likely to be in work between the ages of 50-65 and over 10 times more likely between the ages of 65-74. Moreover, increasing preventative health spend by just 0.1 percentage points can unlock a 9% increase in annual spending by people aged 60 and over, and an additional 10 hours of volunteering.<sup>7</sup>
  - By investing in preventative services for cardiovascular disease, type 2 diabetes and lung cancer, better-off countries can prevent an estimated productivity loss among those aged 50-64 of USD 649 billion each year.<sup>8</sup>

## Using technology effectively

*Prevention in an ageing world*, our flagship report from 2020<sup>9</sup>, argued that to maximise the benefits that prevention brings, we must harness the power of technology.

The world has seen huge technological advances over the last couple of decades, from wearable technologies to artificial intelligence. And in the last year we've seen countries respond to the COVID-19 pandemic by hurriedly turning to technological solutions. Germany launched a smartwatch app that collects pulse rate, temperature and sleep pattern data to screen for signs of viral illness; Singapore is using a mobile app that sends short-distance Bluetooth signals to identify those who may have been in close contact with infected individuals;<sup>10</sup> and much of Europe and the US have embraced telehealth to connect individuals to their GPs and specialist healthcare services.<sup>11</sup>

There's a risk that technology will come to be seen as an easy solution for our biggest health challenges, including the ones associated with prevention.

But the reality is that high-tech solutions have often over-promised and under-delivered. The problem isn't a lack of innovation, but the challenges that come with implementing these solutions and ensuring that they benefit everyone equally.

We know that big data<sup>12a</sup> can be vital in helping to develop targeted preventative healthcare strategies that can improve uptake and reduce health inequalities. We also know that digitising the healthcare system and sharing data<sup>13b</sup> can help healthcare professionals to deliver better and more efficient preventative advice and care throughout our lives and help individuals become more health literate. Yet governments and healthcare systems continue to

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<sup>a</sup>Big data refers to electronic data sets so large complex and diverse that they are difficult (or impossible) to manage with traditional software and/or hardware management tools and methods. In the context of healthcare and preventative health, big data can uncover valuable insights to improve population health outcomes.

<sup>b</sup>Data sharing is about ensuring all those involved in the delivery of public health and healthcare (including patients themselves) have access to patient data (and other relevant data belonging to the individual) that can assist in providing better, more tailored care.

operate in silos and too few have embraced interoperability.<sup>14c</sup> We also know that certain technological solutions such as telehealth can connect individuals with preventative services and activities wherever they are. But only a privileged few tend to benefit.

We need to understand how to overcome these challenges and how to address cross-cutting issues, such as how to foster collaboration and sharing of personal data between public and private actors, as well as individual data privacy and misuse concerns.

New technology has the potential to help deliver prevention effectively and efficiently, but if these issues aren't addressed, it will simply remain a missed opportunity.

Through conversations with health and policy stakeholders over the last two years we've identified four areas where technology has great potential to promote the prevention agenda:

- Improving population health
- Supporting healthcare delivery
- Connecting individuals to preventative healthcare
- Empowering individuals

This consultation paper outlines the potential opportunities and challenges and we've identified examples of good practice across G20 countries. We also have specific questions for you, to help us better understand how technological solutions can help to deliver prevention in an ageing world.

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<sup>c</sup>In the context of healthcare, interoperability is the ability of different information systems, devices and applications (systems) to access, exchange, integrate and cooperatively use data in a coordinated manner, within and across organisational, regional and national boundaries, to provide seamless portability of information and optimise the health of individuals and populations globally.

## Improving population health

Data can be a powerful tool to help improve health outcomes at the population level and reduce health inequalities. High Performance Computing and data analytics can process big data to uncover disease trends and patterns that cover issues like the spread of disease and differences in take-up of preventative interventions.

Insights from such analysis can be used to develop targeted interventions, particularly to improve health outcomes among underserved populations, or those most at risk of ill health. Unlike traditional surveillance systems, analysing big data can provide insights in real time, can use data collected directly from individuals, and can bring together data and intelligence from a wide range of sources to uncover patterns that would otherwise be invisible to us.<sup>15</sup>

But our stakeholders have told us that there are challenges that prevent us from maximising the potential of big data. For example, governments and healthcare systems continue to work in silos with separate systems. And individual concerns over data privacy and misuse of personal data can prevent data sharing.

We've identified some examples where interventions have used big data to improve the health of specific populations and how they have overcome some of the challenges to maximise the potential that it brings.

### Using mobile phones to tackle tuberculosis: India

- The Indian Ministry of Health is working with multinational telecoms company Bharti Airtel to better understand the spread of tuberculosis (TB), using mobile phones to track movement and comparing the data with incidence rates
- They found that people moving frequently between different areas was a better predictor of TB spread than their being in geographical proximity to areas with high rates of TB
- The government was able to deliver targeted preventative and treatment strategies in locations likely to become infection hotspots

This intervention was implemented in the states of Uttar Pradesh and Gujarat. It tracks the movement of 280 million mobile users and compares that data to TB incidence rates.<sup>16</sup> The Ministry of

Health's partnership with Bharti Airtel brought together the technical expertise needed to manipulate the data with a deep understanding of the disease and its impact on local populations.

Analysis found that high levels of movement between different areas was a better predictor of the spread of TB than geographical proximity to areas with high rates of TB. This enabled public health actors to predict the locations likely to become hotspots for infection and to develop more effective and targeted preventative interventions (including diagnosis), along with strategies for treatment adherence and the mitigation of risks associated with drug-resistant TB. For example, targeted prevention messaging and mobile health clinics have been deployed to improve early detection.<sup>17</sup>

### **Advancing COVID-19 research through participatory surveillance: UK**

- The COVID Symptom Study app collects self-reported symptom data from users in the UK
- Insights are shared with the UK government to help deliver targeted public health measures
- App data has successfully identified additional early symptoms of COVID-19 which could help detect a further 31% of cases

Launched in 2020 by ZOE, a health science company, the app collects data from participants to better understand the symptoms of COVID-19 and the rate of spread; it helps identify high-risk areas and those most at risk, by understanding how symptoms are linked to health conditions.

Participants regularly report their health and symptoms and whether they have tested positive for the virus.<sup>18</sup> ZOE shares ongoing insights with the UK government to help deliver targeted public health measures. For example, app data has suggested extending the list of early symptoms that determine whether individuals are eligible for a COVID-19 test. The additional symptoms include sore throat, headache and diarrhoea. This could help detect a further 31% of cases, at a stage when the virus is most infectious.<sup>19</sup>

## Personalising integrated care and preventative pathways: EU

- The “p-medicine project” aimed to improve personalised integrated care with a focus on preventative pathways by using data obtained from a wide range of sources, including individuals
- Active input from individuals was key to collecting data, and helped address ethical and legal concerns over data privacy
- Patients could interact with clinicians and researchers. elearning tools helped them understand how their data was being used and determine what type of research could be done with which aspects of their data

The p-medicine project ran from 2011 to 2015; more than 20 partners in the EU and Japan took part. The aim of the project was to develop new tools, IT infrastructure and virtual physiological human models to help deliver personalised integrated care with a focus on preventative pathways.<sup>20</sup>

The project empowered patients by allowing them to determine which types of research could be carried out with which aspects of their data. Patients actively offered their data through a secure portal where they could interact with clinicians and researchers. elearning tools helped them understand how their data was being used.<sup>21</sup>

## Supporting healthcare delivery

Technology can play a crucial role in supporting healthcare delivery. For example, an electronic health record system gives all healthcare professionals full access to patient data and history. A number of services, such as prescriptions and booking appointments, can also be delivered online. This could help ensure that we receive better continuity of care throughout our lives, ensure timely and effective preventative treatment, and help individuals become more health-literate by enabling them to access their medical history.

These improvements should reduce the burden on healthcare systems by freeing up resources, speeding up internal processes, and improving communication channels between healthcare professionals and patients.<sup>22</sup>

But only a handful of healthcare systems across the G20 – and around the world – have truly embraced this type of data use and sharing, despite wide awareness of the potential benefits for decades. Without committed government backing, and collaboration between private and public actors, countries are slow to change. The EU's General Data Protection Regulation (GDPR) theoretically gives individuals control over their personal (including health) data, but in practice they have limited access, missing opportunities to improve their health literacy.<sup>23</sup>

There are also wasted opportunities due to the continued lack of interoperability between different health systems.

Where multiple public and private actors may exchange personal data, data privacy and misuse concerns must also be considered.

Here we've identified case studies where digitising healthcare records and delivery have improved patient access and outcomes and how they have overcome some of the challenges we've highlighted.

## **A national health information system: Estonia**

- Estonia has one of the most comprehensive e-health systems in the world, with 99% of its health system now digitised, covering 98% of the population
- The Electronic Health Record (EHR) service is a critical component that allows all medical documents to be uploaded to the system
- Political backing, robust legislation, an interoperable system, blockchain technology, putting individuals in control of their data, and training healthcare professionals have been fundamental to its success

The Estonian EHR service allows all medical documents to be uploaded to the system, enabling any healthcare professional to access a patient's medical history from birth to death. Patients can also access their data through a portal, using an electronic ID card or mobile phone. They can also use the portal to book appointments and screenings, and receive appointment reminders, as well as access services such as ePrescriptions (99% of all prescriptions are now electronic), teleconsultations, immunisation passport, virtual health checks, and eAmbulance.

The EHR service is underpinned by legislation that allows all healthcare service providers, regardless of public or private ownership, to upload patients' data into the national system; companies that don't comply are met with financial penalties. Healthcare providers receive regular training, including virtual tutorials on how to use the EHR platform and other software systems.

Patients can see who is accessing their data, and have the legal right to ask why. An opt-out mechanism enables them to restrict who can access to their EHRs. Blockchain technology is used to ensure the integrity and security of all patient data.<sup>24</sup>

Interoperability is key; individual software systems connect to a government data exchange platform, which integrates and digitally records all interactions in a secure central database. This allows new services to be added as and when appropriate. The e-health system is just one part of a wider eEstonia platform that enables individuals to access a range of other services digitally, such as eTaxes and eSchools.<sup>25</sup>

Estonia's journey to a fully digital healthcare system has been marked by strong, consistent political commitment and backing, from the 1990s when the government approved an action plan to guide development of an information society all the way to 2010 when they launched their ePrescription service.<sup>26</sup>

### **Using an EHR system to deliver a targeted colorectal screening programme: Slovenia**

- In 2009, the Slovenian government implemented a targeted early colorectal detection screening programme
- By obtaining data from individuals' unique health identifiers, they were able to target those at greater risk of colorectal cancer, including those aged 50-74
- The intervention succeeded in decreasing incidence rates by 15% among those aged 50-74

In Slovenia, individuals are given a unique health identifier at birth. This identifier enables individuals to book appointments, access their medical records, and view their claims and billing information electronically. -

The Slovenian government used data from unique health identifiers to target free early detection screening to those at a greater risk of developing colorectal cancer. This included those aged between 50 and 74, and those with risk factors for the disease.<sup>27</sup> Individuals can easily manage their appointments, track their test results, receive reminders to attend screenings, and be given further preventative treatment if necessary.

The programme began in 2009; between 2011 and 2016 incidence rates among those aged 50-74 decreased by approximately 15%.<sup>28</sup>

## Connecting individuals to preventative healthcare

Technologies have the potential to improve access to healthcare. The emergence of telehealth enables healthcare professionals to remotely monitor their patients, and can help people in rural and resource-poor areas, those with disabilities, easily access preventative services and help them to live independently for longer. These technologies can also help reduce the burden on healthcare systems by reducing emergency visits to hospital.

While telehealth has the potential to connect underserved populations, our stakeholders worry that without specific consideration of inclusive and age-friendly requirements, or addressing poor digital literacy, the rise of telehealth could widen the existing digital divide, further exacerbating health inequalities or even creating new ones.

We've identified some solutions that address these barriers and help connect individuals to preventative healthcare services.

### **Drone delivery of vaccines and other life-saving health interventions: International**

- A number of drone programmes are delivering vaccines and other life-saving health interventions to remote and underserved communities
- They're cost-effective and can easily overcome geographical barriers, delivering healthcare much more quickly
- They're delivering prevention to millions of individuals around the world

Drones are a faster, more cost-effective way of widening access to health than land-based transport. Across many lower-income countries, drone services have the potential to improve vaccine uptake by at least 36% and reduce the cost of every dose administered by a fifth. In 2019, the Ghanaian government partnered with private and third-sector organisations to launch the world's largest drone delivery service. This delivers routine vaccines to 2,000 health facilities, serving 12 million people across the country. In Rwanda, drones make 2,000 deliveries of medical supplies every day.<sup>29</sup>

## **Telehealth diabetes and hypertension management: USA**

- US-based health IT communications company CAREMINDr provides remote patient monitoring to help patients manage their diabetes and hypertension
- Patients are put onto specific 'condition journeys'; physicians check their progress through the app between face-to-face visits, amending their plan to best fit their ongoing needs
- Patients report having a stronger relationship with their doctor and being able to better manage their condition

CAREMINDr provides mobile-enabled remote patient monitoring solutions that allow physicians to enrol patients with diabetes and hypertension onto condition-specific journeys. Physicians automatically check in on patients through the app between face-to-face visits, creating engagement and modifying their plans if needed. The app provides biometrics and both objective and subjective health status data, as well as wider social, economic, and environmental data to help inform any modifications. Physicians also use home medical devices such as glucometers, blood pressure cuffs, thermometers and pulse oximeters to help track patient health and provide real-time data.<sup>30</sup> Patients report stronger relationships with their doctor, and being able to better manage their conditions.<sup>31</sup>

## **Airedale Digital Care Hub: connecting care home residents to health care: UK**

- The Airedale Digital Care Hub connects 210 nursing and residential care homes to healthcare professionals at the Airedale NHS Foundation Trust via video link or telephone
- Providing 24/7 access via electronic patient records and an online assessment tool, it aims to prevent illness and disease progression as well as unnecessary hospital admissions
- There's been a 35% reduction in hospital admissions and a 53% reduction in A&E use

Care home residents are more likely to live with multiple long-term conditions and less likely to have their health care needs addressed before needing emergency care.<sup>32</sup>

To better prevent illness and disease progression as well as unnecessary hospital admissions, the Airedale NHS Foundation Trust partnered with Involve, a communications provider, to create their Digital Care Hub. Calls are answered by a team of experienced nurses, therapists and paramedics. Electronic patient records and an online assessment tool are used to help deliver care.

An evaluation of the intervention found a reduction of 35% in hospital admissions and 53% in A&E use, and that residents responded well because they could receive interventions in familiar surroundings.<sup>33</sup>

### **Using inclusive design to improve adherence: Australia and Finland**

- These two interventions use accessible technologies to help improve adherence to medicines and preventative treatment for older adults and those with chronic conditions
- They're specifically designed to limit the need to interact with the technology
- Participants have kept up with their medications and preventative treatment requirements

Peninsula Health in Victoria, Australia has implemented ITEC-CHF, an innovative telemonitoring programme for those with chronic heart failure to improve compliance with daily weight management and help prevent their illness from progressing. ITEC-CHF uses a 'zero touch' design to make monitoring weight much easier. Participants don't need to interact with the technology other than stepping onto a weight scale. If there's abnormal weight fluctuation, they're contacted by a nurse to identify the appropriate preventative action. Initial findings suggest the approach has effectively improved patient outcomes and experience.<sup>34</sup>

A Finnish pilot study has implemented an advanced in-home robotic system to help older adults with medication adherence by administering medication at scheduled intervals. The system notification combines sound, an on-screen message, and light. Patients simply press a dispenser button to access their medications.

The device was used for 727 days by 27 patients. The study found that 99% of alerts resulted in on-time medicine sachet retrievals by patients and all patients found the device easy to use.<sup>35</sup>

### **Delivering telemedicine via TV to overcome poor digital literacy: USA**

- In 2020, telemedicine provider American Well teamed up with networking hardware company Cisco Systems to develop a service to connect older adults and those with serious medical conditions to healthcare services via their TVs
- It aims to address digital exclusion by using a more common technology to connect individuals with healthcare services
- The providers hope to reduce emergency visits to hospitals and enable older adults to live independently for longer

Older adults and people with serious medical conditions can now connect to one of American Well's doctors, and its broader network of hospitals, via a live video feed accessed through their TV.

The aim is to overcome barriers, including poor digital literacy skills, by engaging patients through a platform they know and regularly use, rather than through apps or other more sophisticated telehealth services. The intervention's goal is to reduce emergency visits to hospitals and enable older adults to live independently for longer as a result.

## Empowering individuals

Technology can help empower individuals to take control of their health, and improve their health and wellbeing by supporting their health literacy. Many of the solutions aimed at empowering people can be particularly innovative.

But our stakeholders reported that too often these digital solutions don't benefit everyone across society equally. Lack of access to required infrastructure or devices can leave too many excluded from tech-based preventative health interventions. This is particularly likely for those from less privileged socioeconomic backgrounds, those living in developing countries, and those in remote or rural areas. Again, imbalances in access can exacerbate or even create new inequalities in health.

We've identified some case studies where technology has empowered individuals, and others that address barriers to digital health exclusion.

### **A low-tech intervention to deliver preventative health messaging: International**

- Be He@lthy Be Mobile is a population-level text message-based intervention designed to address the growing burden of non-communicable diseases (NCD) worldwide
- With 96% of the world having access to a mobile phone it hopes to reach underserved populations and those most at risk of poor health
- It's proved successful in changing health behaviours and health outcomes for diabetes

The Be He@lthy Be Mobile programme was launched by the WHO to address the growing global burden of NCD; it's particularly aimed at those underserved communities at highest risk of ill-health. With 96% of the world having access to mobile phone networks, the intervention aims to improve health literacy and empower individuals and communities with simple text messages with health messaging. The WHO has partnered with several countries around the world; their initiatives are wide-ranging: from improving awareness about NCD, including the risk factors for type 2 diabetes and cardiovascular disease, to messaging on how to quit smoking, and from information on cancer screening to helping individuals

better manage chronic illness through long-term behavioural change techniques. The intervention has successfully targeted particular population groups and specific times of year to help reduce hospital admissions.

In Senegal, messages have been sent to 180,000 people during Ramadan since 2014. As this is a period of high sugar consumption and dietary irregularity, the messages focused on keeping type 2 diabetes under control. An evaluation found that it improved glycaemic control in people with type 2 diabetes.

India's diabetes programme has 107,000 registered users. It uses algorithms to target specific groups, such as older adults and people at risk of, or living with, type 2 diabetes. In 2017 57% of registered users followed a healthy diet, 72% followed advice on physical activity, 52% were screened for diabetes, and 67% checked their glycaemic status.

More robust evaluation is needed to identify the effectiveness of the intervention with other NCDs.

### **Using social media to connect individuals to preventative health: USA**

- Facebook US has launched a free preventative health tool (embedded in their social media platform) that helps manage and track regular screenings and vaccinations and lets people educate themselves on the importance of routine health checks
- From a user's age and sex, it generates a list of recommended screenings and vaccinations and where to receive them, including low-cost options, plus a schedule to track their appointments
- Although still in its infancy it has the potential to reach a large proportion of the population

In 2019, Facebook US launched a tool that reminds individuals of regular cancer screenings, heart check-ups and flu vaccinations. The platform takes the user's age and sex from their profile page and generates a list of recommended screenings. The connected app can then provide information (taken from organisations such as the American Heart Association and the Centre for Disease Control and Prevention) about the different tests available and suitable locations.

Users can schedule reminders for screenings and log when they've had them.<sup>36</sup> It also lets users search for more affordable options.

Although still in its infancy, the app has great potential, as it connects health issues to a platform that a significant proportion of the population already uses. Incorporating it into people's routine activities is also likely to empower them to take control of their health.<sup>37</sup>

### **Using gamification to encourage individuals to adopt healthier behaviours: International**

- Plague Inc. is a low-cost app that uses gamification principles to educate individuals about serious health topics
- Mango is a free app that uses monetary incentives to motivate individuals to take their medications on time and educates them about the potential side effects of co-medication
- Both aim to engage users in an appealing way at a low cost.

Plague Inc. is a game that simulates disease spread; players select a pathogen and work out how to control (or encourage) its spread. The game aims to educate the public on epidemiology, disease, disease transmission and serious public health topics. More than 700 million games have been played.<sup>38</sup>

Using behavioural economics to engage people and help them overcome a cognitive bias against healthy behaviours is a common approach used in gamification. Mango Health is a free app designed to motivate patients to take their medications on time, by setting reminders for when medication should be taken. It also provides information about medications and warns about drug interactions and side effects. When users adhere to medication regimens they earn points towards gift cards or charitable donations in weekly raffles.<sup>39</sup>

## Using artificial intelligence to empower individuals: International

- Two free app-based interventions use artificial intelligence (AI) to empower individuals with health information
- Healthily helps individuals find personalised health information and creates personalised health hubs via a chatbot and mobile app
- Symptoma is a digital health assistant that aims to reduce misdiagnosis and delayed diagnosis by letting individuals check symptoms for possible causes

Healthily is a free app-based service that uses AI to help users around the world find health information online. It takes personalised user-provided health information via a chatbot and mobile app and creates personalised health hubs. The app contains health information on a range of subjects, including eating and sleeping better, and how to perform self-examinations. It's been downloaded more than 3 million times – but the goal is 1 billion.

Symptoma launched in 2019,<sup>40</sup> is an AI health assistant that improves diagnostic quality: it can identify over 20,000 diseases with more than 90% accuracy. Its aim is to reduce misdiagnosis and delayed diagnosis, which result in 1.5 million deaths globally each year and account for around 30% of total healthcare budgets.<sup>41</sup> Based on 14 years of scientific research by medical doctors and data scientists, this tool is the most commonly used symptom checker worldwide among both doctors and patients.<sup>42</sup> It currently receives funding from EU's Horizon 2020 research and innovation programme.

## **Digital literacy skills for the homeless and insecurely housed: UK**

- This intervention aims to help local homeless and insecurely housed people improve their digital literacy so that they can use these skills to access health services
- Digital health champions help them find health information and online support with computers in community locations such as libraries
- Those using the service are better at adhering to medication for long-term conditions.

A homeless charity in Hastings has partnered with NHS Digital and NHS England to help local homeless and insecurely housed people access health services.<sup>43</sup> The aim of the project is to prevent further exacerbation of the inequalities in health outcomes and access to health services that already exist for this group.

Computers are set up in common spaces and locations such as libraries; digital health champions help individuals learn how to find health information and online support. The programme has found that those using the service are better at adhering to medication for long-term conditions.<sup>44</sup>

## Consultation discussion

While many of the questions we have for you cut across more than one of the areas discussed in this paper, they represent what we believe are the main barriers to maximising technology's potential to help deliver preventative healthcare.

### How can we maximise the potential of technology?

Throughout this consultation paper we've identified the technology's potential in helping deliver prevention.

#### Priority question:

#### 1. How else can technology be used, both within and beyond the healthcare system, to help deliver prevention?

We know that if we want to maximise the potential of technology we must ensure strong political commitment and backing, and help foster public-private partnerships. Doing so can help healthcare systems offer more digital services, and help to support greater use of big data.

#### Priority question:

#### 2. Who do we need to influence to maximise the potential of technology in delivering preventative healthcare?

3. How can we convince governments to commit to investing in digital healthcare delivery, and in particular, to adopt electronic healthcare record systems?
4. What barriers prevent partnership between public and private actors, and how can these be overcome?

### How can we tackle the barriers to using technology effectively?

Health technology can help to overcome distance and connect underserved individuals to preventative healthcare to help them live well for longer. It can also empower individuals to take control of their health, and improve their health and wellbeing by supporting their health literacy. That said, digital exclusion continues to prevent people from benefitting from these technological solutions. From adopting inclusive, age-friendly designs to improving digital literacy and using low-cost or low-tech solutions, we've highlighted ways to bridge the digital divide and prevent the widening of health inequalities.

### **Priority question**

- 5. How can we tackle the digital divide and ensure technology doesn't exacerbate or create new health inequalities? What examples of good practice can we learn from?**
6. How can we encourage the development of inclusive, low-cost and low-tech solutions?
7. How else can we overcome distance barriers without further excluding some people from preventative healthcare services? And how can telehealth be developed to be more inclusive?

Blockchain technology, giving individuals control over their health records, and actively involving them in providing data to aid disease surveillance can help address data privacy and misuse concerns, address barriers to data sharing, and can help individuals become more health-literate.

### **Priority question:**

- 8. How else can we address data privacy and misuse concerns? How can we give individuals greater control over their data?**

With advances such as the emergence of smart cities and solutions based on the internet of things (IoT):

9. How can we properly promote innovations while protecting individuals' rights?

We know that having interoperable systems is crucial to facilitate data sharing. Making healthcare data systems talk to each other can help us maximise the use of big data and can also support healthcare systems to deliver better and more efficient advice and care throughout our lives.

### **Priority question:**

- 10. How do we deliver interoperability?**

One of the reasons data isn't shared is because many governments and healthcare systems continue to work in institutional silos.

11. What other barriers prevent data from being shared? How else can we encourage data sharing, particularly to maximise the potential of big data and to support healthcare delivery?

## How do we measure success?

We're not short of technological innovation, but too often interventions based on these innovations aren't successful.

### Priority questions:

- 12. How can we ensure health technologies are successful when implemented? How can we ensure that they actually deliver their potential?**
- 13. How can we measure whether a technological health intervention is cost-effective? And how can we get better at measuring cost-effectiveness?**
- 14. Are you aware of any other factors that aided in the success of the case studies in this paper? In particular, the processes that supported collaboration between public and private actors?**

## What else have we missed?

We'd also like to hear from you if you think there's anything we've missed:

- What other mechanisms and levers are important in ensuring technology can help support preventative health efforts?
- Can you share other examples of health interventions that work, are cost-effective, and help to minimise the digital divide and reduce health inequalities?

We invite your thoughts and feedback. You can respond to the consultation **here** until Wednesday, 30 June 2021. Thank you for your help – it's vital to our programme.

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## About the ILC

The International Longevity Centre UK (ILC) is the UK's specialist think tank on the impact of longevity on society. The ILC was established in 1997, as one of the founder members of the International Longevity Centre Global Alliance, an international network on longevity.

We have unrivalled expertise in demographic change, ageing and longevity. We use this expertise to highlight the impact of ageing on society, working with experts, policy makers and practitioners to provoke conversations and pioneer solutions for a society where everyone can thrive, regardless of age.



**International  
Longevity Centre UK**

Vintage House  
36-37 Albert Embankment  
London SE1 7TL  
Tel : +44 (0) 203 242 0530

**[www.ilcuk.org.uk](http://www.ilcuk.org.uk)**

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