Dr Hannah Marston[1] and Dr Charles Musselwhite[2] – Written evidence (INQ0010)

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Drs Marston and Musselwhite would like to offer the Science and Technology Select Committee, evidence under the sub-section **Technologies** points **5-8**.

5. **What technologies will be needed to facilitate treatments for ageing and ageing-related diseases, and what is their current state of readiness? For example:**
   a) Technologies for monitoring conditions and providing personalised medical advice
   b) Technologies for monitoring healthy living e.g. fitness, diet, etc.

Technologies such as digital games, mobile apps and wearable devices can facilitate active and healthy ageing (AHA) in society. Existing evidence illustrates the concerns of both tech savvy and low-level digital literate users, especially when it becomes crucial for owning and integrating smartphones and associated technologies into their lives. Exploring how technologies can impact and offer older cohorts in society to maintain AHA has been explored on an international level via the iStoppFalls EU study (2011-2014) aimed to design, develop and implement an ICT-based system to facilitate physical activity in community dwelling homes across 3-sites (Germany, Spain and Australia), to reduce the risk of falling. Evidence from this international study identified several promising results via a randomized control trial (RCT); for the integration of digital exer/games into society and into the homes of older adults, from the standpoint of usability and user acceptance [1], existing use, understanding and ownership of technology [2], enjoyment/immersion of interacting with digital games [3] and whether such a system is capable of facilitating physical activity as a means of reducing the risk of falls[4-5]. The RCT design included community dwelling (n=153) aged 65+ years across 3 study sites. Participants assigned to the intervention group (IG) were required to use the exercise program for 16-weeks, with a recommended dosage of 120 min/week for balance exergames, and 60 min/week of strength exercises. All participants in the IG and control groups received educational material relating to fall prevention and living a healthy lifestyle. The results from the RCT showed a reduction in physiological fall risk in the study sample, with further analyses ascertaining participants assigned to the intervention group with greater adherence also improved in their postural sway, stepping reaction and executive function [4-5].

When integrating technology into organisations or segments of society, it is important to understand how populations (old and young) will adopt and use this specific technology in their daily activities. User experience/usability in conjunction with other facets such as whether using such technology was perceived positively or not is important. The iStoppFalls EU study (2011-2014) offers insights and results from the standpoint of usability [1], which in turn demonstrated positive trends, based on good usability, user experience and

acceptance. Additional results surrounding participant engagement and experience of immersion/enjoyment [3], showed a positive trend, whilst data analysis identified no significance across age cohorts. Overall, European participants experienced greater enjoyment in particular having 'clear goals. Two instrument items *'clear goals'* and *'my attention was focused entirely on what I was doing'* were known to display the effects of flow/immersion when exploring data analysis from a gender standpoint; identifying women more so than men experienced flow/immersion. Recommendations were proposed and included taking a qualitative data collection approach (e.g. focus groups) to gain greater insight into users/players experiences.

Wearable devices have the potential to support health practitioners (e.g. GPs, consultants and specialist nurses) in remote monitoring of populations be it who live in rural, urban or city locations. However, remote monitoring such as the implementation of wearables via a smartphone bring additional support to users and their support networks. It should be considered and not assumed that not everyone will have a smartphone and their digital literacy and health literacy may not be high. Attaching wearable/mobile health devices to equipment which can offer a patient/user some sense of relief whilst also continuing their day-to-day activities. This notion is supported by a piece of evidence relating to the exploration of using and integrating wearable/mobile health devices into populations who experience Arrhythmia (AR). This scoping review focuses on mobile self-monitoring of ECG device to diagnose Arrhythmia (AR), which coincide with palpitations; and illustrates how such technology lends itself to further exploration, testing in the field (by different users, CCGs) and health practitioners [6]. This review returned (n=9) papers, which show positive trends towards using mobile ECG devices across different societal cohorts. Several recommendations are proposed to expand this work to ascertain how mobile ECG devices can be used within society intersecting at different levels of the community and health care. For example, employing a multi-methods approach (qualitative and quantitative) to establish the impact and perception of such technology by user's and support networks. In conjunction of understanding the barriers and facilitators of this type of technology within and across the health system. Establishing the perspectives of using mobile ECG devices from the standpoint of health practitioners (GP, Cardiology Nurses, Consultants), and how such devices can assist their daily practices. More importantly, ascertaining the exact cost-savings of using such technology across the NHS is critical and taking a case study or feasibility approach will offer evidence into cost-savings as well as the barriers and facilitators to using such technology more fluidly than a randomized control trial. Finally, qualitative data has to be used as a means of understanding user/patient engagement, impact and perception. This approach to understanding

6. What technologies will be needed to help people to live independently for longer, with better health and wellbeing? What is the current state of readiness of these technologies, and what should be done to help older people to engage with them? For example:

a) Digital communications for services, social interactions, etc.
b) Devices, machines, etc. for daily living in the home

Technology alone will not facilitate cohorts to live longer. However, technology will offer some comfort to all cohorts across society the ability to stay connected and engaged with family members and friends who live in different location both nationally and internationally. To offer insight, we draw on evidence from the *Technology In Later (TILL)* study (2015-2017) an international study comprising of two rural sites (McBride CA, South Wales UK) and two urban sites (Regina CA, Milton Keynes UK). TILL evidence [7-8] illustrated adults (n=37) aged 65+ years, living in both rural and urban areas of the UK and Canada integrated several foundations for using ICT in their lives including: social connectedness and safety, while living in different geographic locations. Older adults narrated their use of technology to *access leisure activities,* whilst also highlighting the *drawbacks of using technology* which may have inhibited participant engagement. Primarily, the participants chose to communicate with their loved one's via email, What's App, Skype instead of more traditional ways (i.e. writing a letter) [8].

c) *Transport, infrastructure, services, etc. for involvement in community*

Looking ahead, a number of exciting technology developments are promised to revolutionise the transport network. Improved digital technology, increased automation and the growing prevalence of the sharing economy are all promised changes in transport provision over the forthcoming years [9]. These include, but are not limited to real-time transport information (to show live delays, departures and arrivals), smart ticketing (integrating ticketing between services), interfaces between technology and enhanced taxi services (e.g. taxi services enhanced through technology such as Uber, Lyft), and mobility as a service (provision of different transport services as one, bringing together taxis, car park charges, train tickets, bus fares as one payment through one portal), automated vehicles (cars with different levels of automatic elements of the driving task which are currently carried out by the driver themselves) and driverless cars (where the driver does not need to drive any part of the vehicle at all).

There has been large investment into automated vehicles by the UK government, but most research across the world is either engineering or computer science based. While it is important to get the technology right, doing this in isolation from potential impacts on society will result in imbalanced and potentially excluding provision. For example, while older people, especially those who have given up driving, are highly supportive of automated vehicles, they lack knowledge and insight into the consequences of such technology. For example, they support autonomous vehicles in relation to carrying on driving to the things they do now, longer and later on in life than they can do now [10]. But, there is little realisation of how services, shops and facilities may change and how some journeys carrying goods or passengers will no longer be necessary. There is also little knowledge of costs of using autonomous vehicles and ownership of such vehicles; older people again assume it is business as usual. Finally, there is little knowledge on how the built environment will change as a result of autonomous vehicles, both at a microscopic level, for example sharing space with pedestrians and cyclists and macroscopic level, changes to location of facilities, services and shops. It is important to note that highly automated vehicles are potentially a long way off, and vehicles are likely to

continue to need a driver to respond or take over in difficult or emergency situations. It is generally appreciated that older people would find re-taking over control of the vehicle harder than younger people, because of changes in physiology [11]. Many of the benefits of modern technological solutions imply an amount of sharing of services. However, older people have trouble with the idea of sharing services, especially those who are drivers and own their own vehicles [10]. Thus, we conclude sharing mobility is probably more of a challenge than is currently acknowledged.

Travel integration is important for older people. Integrated transport is very important for older people when making a journey. Reducing excess cognitive or physical strain associated with changing modes or waiting long times between services or having to remember and understand different ticketing types can be barriers to undertaking journeys. Having the security and information of a journey in one place, with one cost and one ticket, with guarantees of services across different modes including what to expect and how to navigate any physical interchange would have benefits for older people. However, there is at present very little research on MaaS for older people and it is hard to ascertain hoe far the potential might happen. At present MaaS is very much a concept. A number of places are making significant steps towards enabling the implementation of MaaS, for example, Helsinki in Finland. However, what is missing is knowledge of how the service might look from a provider and user perspective. Using focus groups to discuss MaaS found it had appeal among older people, and they felt it could help drive down cost and make public transport easier to plan for and to use, but it was hard for them to see how it could become a reality with too many barriers being in place [10]. There is a significant potential market of older people contemplating cycling in the UK, yet perceptions about poor health coupled with poor infrastructure are huge barriers. A growth in power assisted bicycles, such as e-bikes, offers potential and should be explore further [12].

d) Accessible public spaces.

Older people want more involvement in shaping their public space [13]. Technology can be used to support co-production of public space through the development of tools and apps to help capture and map barriers and enablers to the built environment. This can develop into an index of age friendliness of the public space, for example OPERAT tool developed by Swansea University [14].

Traditional pedestrian crossings are set at a walking rate of 1.22m/s, [15] found 88% of older people fail to complete a pedestrian crossing before it turns back to green for the traffic. Research suggests this can be one of the reasons older people do not walk to destinations. Technology can be used to increase time for older people to complete crossings. Neatebox Button. Button enables users to use their mobile phone mobile or smart watch to press the buttons at pedestrian crossings. This could be coupled with allowing extra time or even allowing the person to cancel the crossing at the end. There are examples of these in Largs, Scotland, where 10 pedestrian crossings were enabled in Summer 2017, along with one in front of the Locharbriggs Village Hall. Singapore Card Scheme. In 2009, Singapore's Local Transport Authority started Green Man Plus, piloting it at five intersection crossings. People who hold an over 60 or disability fare card for free or reduced travel on buses can apply for a special card they can swipe at

the traffic light sensor and it gives them an extra 3 to 13 seconds to walk across, depending on the size of the crossing. It now operates in 495 crossing across 30 housing estates.

Older people want more information about transport, to help them plan their journeys better. There is significant support among older people for improved information provided through technological means, especially if that helped reduce physical and cognitive burden of mobility, for example continuation and improvement of real-time travel information and accessing mobility through apps [10]. Audio guides. "Talking App" is a smartphone app that provides real-time passenger information to all users (although specifically designed for the visually impaired) in an audio format. Another technological solution is an audio-visual bus stop information. It has become the norm to have audio announcements of next bus stops on many buses however, less common is such provision at bus stops. Greater Manchester is involved in a pilot via the City Verve project.

e) Smart Homes.

Technologies such as virtual assistants (VA) can offer citizens old and young, with and without disabilities different types of assistance within the home environment. Such aid includes, medication reminders, weather reports, security and safety, especially if respective citizens are disabled or have long-term health conditions which makes them prone to falling. Installing VA's into the home environment and connecting with specific lights and sensors, in conjunction with a smartphone enable the resident to review who may be at the door (added security), or can raise the alarm should the resident need the emergency services and/or family/friends [16] –[17].

7. How can technology be used to improve mental health and reduce loneliness for older people?

Technology can facilitate loneliness by enabling older adults to be connected with friends and family via social media platforms (i.e. Facebook), or communication platforms such as Skype, Facetime, What's App, or Viber. Such platforms are particularly important for family members who live in different geographic locations -within the same country and internationally. This is evidenced from the Technology In Later Life (TILL) study by participants narrating their experiences, reasons and perceptions for using certain types of technology in their lives:

> *"I've used Skype because my daughter lives in South Africa, but it's an atrocious service because South African broadband is atrocious. We now use Apple FaceTime and that is far superior. [MK3, Male]"* [7]

> *"I think it's far easier to use a Skype phone. I just use it because you are always going to be sitting there, waiting for the other person on the other end. And if you have just got a phone, you know ring them up, okay, if they're not answering, they're not answering, end of story sort of thing. Go back later." [W7, Male]* [7]

"I have to say I could not live without a computer and a laptop, very essential tools in my life really in terms of social life and very much my involvement in voluntary organisations, which lots of reports, lots of communication. (participant living in urban UK)" [8]

"I go on Facebook and I go on Skype with my daughter in Australia and I do research things. Last night I was talking to my grandson, who's seven. I was telling him about the exciting things that I'd done in my life, like I've been dog sledding. I Googled dog sledding and this picture of a dog sled, so he understood what I'd done, and skiing and all these things. (participant living in urban UK)" [8]

Exploring and understanding how technology impacts day-to-day lives is crucial for greater roll out of technology across key organisations in society (i.e. NHS). Whilst the quotes above illustrate the ease in which older adults (65+ years) who are living in two different countries have integrated technology into their lives, there are some adults that do not always find technology use easy, coupled with jargon, cost (including ongoing tariffs), installation and infrastructure.

8. What are the barriers to the development and implementation of these various technologies (considered in questions 5-7)?
a. What is needed to help overcome these barriers?

Based on the evidence published from the TILL study [7-8] participants aged >65+ years residing in urban and rural geographic areas have different concerns. For many participants in the TILL study, they noted how learning a new piece of technology can be difficult, in conjunction with using technology to access government services and/or health service (i.e. GP appointments). They found jargon was a problem, and also a feeling of apprehension if they had to enter a high street shop to ask for assistance. Recommendations include a peer support network to assist in learning new technology, whilst intergenerational relationships have the potential to play an integral role in technology support.

Secondly, detractors and enablers of technology use can be identifiable across many segments and populations in society. For example, loneliness does not only occur in later life but can affect both young/older adults, including carers (of all ages), who are caring for both young or older dependents (with and without disabilities). Caring for a loved one, can include many different facets and technology can offer all users the opportunity to feel/be connected, as well as offering a sense of safety within the home [16] –[17]. Installing virtual assistants within the home can offer and support citizens an additional layer of safety in addition to a peace of mind for their family and support network. Furthermore, virtual assistants can provide children and young people with confidence in speaking and delivering instructions, teaching the child to speak clearly and concisely. This is demonstrated in [17], by a child under the age of 10 as the VA a question.

Technology is not going to solve the problem of loneliness and social isolation. However, what it can offer is a barrier to forging and maintaining social connections, including intergenerational relationships within the same country and overseas. The notion of integrating technology and AI into The National

Health Service as a way of solving the health and social care issues is an example of how powerful individuals are been badly advise by individuals who know little or nothing about the issues surrounding technology use in day-to-day lives.

Taking the example of using and deploying mobile ECG devices within a GP practice and clinical setting. For this to be integrated, takes a lot of effort, understanding and education (e.g. technology been taught at medical schools). Health practitioners at varying levels of the NHS have to be positive to use such technology, otherwise installing mobile ECG devices will not be successful. However, another problem with this is having a suitable digital device for the mobile EGC device to be attached by the health practitioner/patient. The Technology In Later (TILL) study illustrated various concerns by individuals living in both rural and urban geographic locations. Although the cost of purchasing technology was not reported by participants from the TILL study, the cost of technology, installing the internet and infrastructure across the UK has to be considered. If the infrastructure is not in place then there is little point to conducting Skype calls between a patient and a GP/consultant. There are areas on the outskirts of London (e.g. Milton Keynes) that are poorly equipped to hold mobile phone connections, yet there are rural areas across the UK where mobile phone signal is non-existent and 4G has not caught up.

The evidence documented here illustrates how technology can benefit citizen, as well as positively impact their lives, whilst aiming to be realistic. Overall, there is a lack of information surrounding the needs, issues and concerns of younger adults, and how they perceive the impacts, barriers and enablers to technology as they age. However, the Technology 4 Young Adults (T4YA) study aims to bring this information into the domain, offering insight into technology use and concerns by Millennials. Furthermore, little is known about the impacts and concerns of technology by Generation X. from the standpoint of active and healthy ageing, Generation X are a cohort that is following in the footsteps of Baby Boomers, but who are tech savvy. To date, Generation X has been overlooked by academe, UK Governments, and the UK press. Given how digital games have received a vast interest from national and international scholars in a bid to identify and ascertain suitable approaches to rehabilitation [18], and preventative health [4] social gaming [3], design and development [5], [20], [21], [22] little attention has focused on Generation X with the exception of [23].

Therefore, we believe greater attention is needed to understand the needs, issues and concerns surrounding younger adults (i.e. Generation X, Millennials, Generation Z) as a preventative measure and adequate planning for the future. If technology is to be integrated into different levels and segments of healthcare delivery, and society then it is crucial that a multi-disciplinary approach is conducted; keeping in mind that citizens have various levels of digital literacy, financial issues and overall perception of seeing and understanding the benefits of technology use. It should also be considered, for many citizens, their monthly finances are stretched due to rising day-to-day living costs (e.g. rents, fuel etc.). Citizens experiences of using technology and peripheral devices is variable, and one size does not fit all. The respective evidence provides an in-depth insight into the various issues, concerns and enablers from 21st Century users.

Drs Marston and Musselwhite, believe a multi-methods approach is required to ascertain key knowledge surrounding user adoption, engagement and experience of technologies in their day-to-day lives. This type of evidence documented from the Technology In Later (TILL) study and Technology 4 Young Adults (T4YA) study offer insight into the very concerns that are usually not addressed in larger studies and consortiums across the UK. Greater work is needed taking a geographic approach which will offer insight and evidence into infrastructure and the barriers which are encountered by respective citizens in these locations. Educational training should be addressed at different levels of the education system to ensure existing and future health practitioners understand the benefits to using and deploying technology with their patients.

Greater work and evidence is needed across different cohorts and geographic locations of the UK to realise the great extent of the barriers and enablers to technology use, adoption, perception and impact on UK citizens. All citizens should have the opportunity to have a voice, and to express how technology can be beneficial for them in day-to-day living.

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