IMAGINING THE FUTURE: ENABLING TECHNOLOGY

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IMAGINING THE FUTURE - ENABLING TECHNOLOGY:
HOW TECHNOLOGY MIGHT AFFECT SOCIAL CARE BY 2025

1 BACKGROUND

Predicting what might change by tomorrow, next week, next month or even next year is relatively safe. But in 10 to 15 years, there is time for the rule book to be completely rewritten and for all accepted learning to be cast aside to be replaced by something completely different. Some activities that are common today might have seemed improbable fifteen years ago (in the late 1990s), for example using the video game consoles to help recover function following a stroke or a fall, or ordering groceries online via TV screens.

Predictions must have both a basis in **technology** but must also be considered with respect to the **likely speed of adoption**, and the natural resistance to change (i.e. **cultural acceptance**). By concentrating on technologies that are designed to improve quality of life, help people to perform tasks more easily, or which manage the risks associated with independence, we will move some way towards understanding how social care may develop and how the tools available to social workers will need to change.

But this will be only half of the story, and perhaps not the half that will have the greater impact. Technological developments in other areas - politics, culture, energy, national finances, diet, ethics, privacy and transport policy - might have an even greater impact on people who are deemed to be vulnerable or needy as they might live on the margins and, therefore, be more susceptible to relatively small changes. Relatively small doses of such innovations might then become an important aspect of strategies or interventions that social workers are most likely to propose.

This project therefore requires a **dual track approach** that involves

1 a consideration of existing technological developments and
2 how other changes could make a difference to people.

The **first part** reviews technologies and trends that are already happening. This is moderated by how society will change, both in the way that it reacts to the technology, and in the way that its values change as a result of external factors such as the economic status of the country, the ability of the NHS and other organisations to deal with the needs of an ageing population, and various other events that can change attitudes either overnight or over the course of time.

The **second part** draws on six vignettes (or case studies) as a way of helping us imagine how outcomes might be different depending on the kinds of technology and communication that are available. These case studies offer opportunities to consider

- Firstly, the type of person and the range of issues that are likely to affect people and families.
- Secondly, the likely impact of technology on such cases. Not surprisingly, some cases will need the same dedication of social work staff and traditional means of support that they might require today, and did require ten years ago. Others might require a very different approach, and outcomes that could depend on the availability of, and access to, new technologies. These represent perhaps the most exciting cases because they can show improved outcomes, lower cost, and greater satisfaction for all stakeholders if the initial consultation, assessment and prescribed service take advantage of the relevant technological interventions.

2 TECHNOLOGICAL CHANGES THAT COULD HAVE A DIRECT IMPACT ON SOCIAL CARE

Taken as whole 'technological' developments can be overwhelming, so this section breaks up technology into discrete elements and considers the likely impact of each. In this way we intend to make it easier to understand and to imagine in a real and constructive way how and when they might become significant.

2.1 Personal computing

In reality we absorb and integrate new technology all the time, some of us a different rates than others. Consider how, over 40 years, computers and the internet moved from being obscure and specialised tools to driving commonplace consumer devices. Most computing devices already have more processing power than the spacecraft that landed men on the moon in 1969.

1970	• A computer was a large device (a 'mainframe', the size of large wardrobe) that required a carefully regulated air-conditioned room
	  ○ Information was input through punch-cards
	  ○ There was no keyboard and no video display

1980s	• The first personal computers arrived but were mainly for enthusiasts • Word processors arrived in offices allowing text editing and formatting • By the end of the decade desktop PCs were popular but still relied on the user learning arca commands (eg the Amstrad)
1990s	• Email virtually unheard of at work and at home • The Apple Mac with its pointing device (mouse) and Graphical User Interface made it possib to use a computer without learning arcane commands • Microsoft followed with Windows and by the end of the decade desktop computers were commonplace • In the mid 1990s the word wide web arrived and the word 'internet' entered everyday vocabulary • 'Dial-up' access to the internet available at work and at home via a modem and telephone l • First generation of mobile phones take off – texting unexpectedly popular
2000s	• Broadband replaces 'dial-up' allowing 'always on' internet connection • Smartphones allow us to connect to the internet on the move • Smartphones can record video • Youtube allows free sharing of video • Online shopping commonplace • Laptops increase in popularity • Email widespread in personal and working life • Social networks part of everyday life (eg Facebook - one billion members) • Email widely considered a plague that needs controlling
2010s	• Tablets increasing in popularity at expense of laptops • Touch screens • Video phone (skype) making face to face communication an affordable reality • Email widely considered a plague that needs controlling • Future Identities report finds 'People are accustomed to switching seamlessly between the internet and the physical world, and use social media to conduct their lives in a way that dissolves the divide between online and offline identities' http://www.bis.gov.uk/foresight/our-work/policy-futures/identity

Accessibility, acceptability and fashion

People adopt new technologies at different rates and some reject them completely. The mobile phone might seem ubiquitous, but some people refuse to have anything to do with them.

Some new devices are emerging such as an 'i-watch' - a kind of i-phone worn on the wrist, while a number of companies have suggested that they will use flexible electronic circuit boards to produce conformable devices that might be integrated into clothing or produced as a band that could be worn on the forearm.

Google has been experimenting with heads-up displays which would allow someone to view a display without having to carry a screen. This approach would enable an individual to receive real-time information as they walked around. It might promote virtual visits to distant locations and virtual reality scenarios for games will increasingly interact with the real world.

It is likely that there will be an increasing choice allowing users to select devices most appropriate to their own lifestyle. Ease of use may become a more important factor in future designs, thus enabling all citizens to enjoy ownership and applications of the technology.

It is possible that not owning such a device, or not being able to fully utilise it, will become a characteristic of the disadvantaged few - and perhaps the people who will most need help from social workers.

2.2 Information generation and storage

As recently as ten years ago the amount of digital data or information we could store was strictly limited by the capacity and cost of storage media: tapes, floppy discs and hard drives. The cost has fallen so much that today there is, effectively, ample space to store all the data that we can create.

The challenge is to store it securely and in such a way that it can then be retrieved quickly when needed and from any location.

We can now easily access bus and train timetables online, the Kindle has created a huge market in e-books and even the Argos catalogue is expected to be available only as a digital download.

Cloud storage is the term used to describe a world in which we no longer keep our data (documents, books, photos, video) on our own devices. Instead we store them on cloud services such as Flickr, Youtube, Google Drive. We can even keep personal data such as receipts using services such as http://www.immobilise.com/ which offers an online

portfolio for your personal belongings. And Final Fling is an example that enables us to plan for our death.

If entire identities are effectively digitised and stored in this way, people who have not allowed their data to be created and warehoused in this way will be seriously disadvantaged. They could be forced to join an underworld of digital refuseniks who are unable to apply for jobs, for a passport, for a driving licence and for welfare payments.

2.3 Stratification and analytical techniques

The amount of data collected about each individual in society is increasing rapidly. The data gathered by government and health systems tends to be highly structured which allows easy comparisons to be made between any individual's result and an average value for similar people. This leads to important knowledge of distributions and how they might change over time.

But commercial organisations, such as supermarkets and online retailers, also routinely gather data about our purchases, our movements and our preferences. This is known as **Big Data** and analytical techniques, known as **Data Mining**, are evolving which look for trends that might offer some level of prediction.

From an individual perspective, Big Data can tell people how much they are like everybody else. Indeed, a personal analysis might tell them that there are another several hundred people just like them in Glasgow, in Scotland, in the UK, in Europe or in the world. How this information is used is the important issue. If it is used to make people feel 'normal' then it can be positive, but equally, if it is used to stop people feeling that they are 'special' then this could lead to a loss of self-esteem.

2.4 Communication technologies

The origins of social alarms lie in sheltered housing. The assumption during the 1950s and 1960s was that the people who needed to live in this type of accommodation were both vulnerable and relatively poor. As telephone lines were, at that time, a luxury which couldn't be afforded by many, hard-wired warden-call systems, similar to the hospital bedside call, were devised. Subsequently, they evolved into two-way intercom systems between the resident and a call monitoring centre, rather than a local warden.

These hard-wired arrangements were bespoke to each manufacturer and were therefore limited in performance and in linking in with other peripheral devices and telecare. During the 1970s the telephone became less of a luxury and the number of households of all income levels who had their own telephone lines rose rapidly.

The 1990s saw the emergence of home computing: the BBC Micro and gaming machines such as the Commodore 64 and the Attari. Electronic mail (e-mail), until then the preserve of academic and research institutions, moved into the mainstream, at first connecting via (relatively slow) modems and ordinary telephone lines. One drawback was that the telephone could not be used at the same time as the computer was connected to the internet, a frequent cause of family friction. In the late 1990s and early 2000s this problem was solved when broadband became more widely available and cheaper allowing faster speeds, an always-on facility and the ability to use the telephone at the same time.

As broadband speed and capacity continued to increase so did the ability to use the internet to access video, music and all kinds of electronic commerce (for example shopping, travel).

Perhaps even more dramatic have been the improvements made in mobile communications. Third Generation (3G) phones allow us to use the Internet 'on the move' via smart phones and tablet devices. Fourth Generation (4G) began rolling out in 2012 offering faster access.

By 2025 one can confidently predict that wireless communications will be available across the UK and with a bandwidth which can support both audio and video services.

Effectively, anyone who wants to speak to people will be able to do so, and the only people who will not be able to do this will be those who wish to hide or to avoid contact.

2.5 The internet of things and the Quantified Self

The internet works by connecting computers around the world. Each computer connected to the internet has a unique address (known as an IP - Internet Protocol - number). Many devices now contain some kind of microchip which makes such a device, in effect, a computer.

This means that electrical appliances, from washing machines to refrigerators, can communicate with other machines also connected to the Internet. Indeed, manufacturers have provided this facility for a number of years in order to monitor performance and to check remotely on their operational status. The same principle can be applied in agriculture: a cow on a farm could be identified by an IP address, allowing the farmer and a dairy to its monitor its milk output or its health.

As more and more devices acquire an internet address we talk about the 'internet of things': 'equipping all objects in the world with minuscule identifying devices' (http://en.wikipedia.org/wiki/Internet_of_Things). These things might include buildings, the home, healthcare and transport, healthcare providers, cars and emergency services, locations such as industrial parks, hospitals, car parks and police stations, and devices such as tablet computers and cash machines.

The development of small and relatively low-cost medical devices for measuring relevant vital signs or medical parameters, such as pulse rate and blood sugar level, means that individuals can take their own measurements and then take responsibility for understanding their meaning (with appropriate support where necessary) and modifying their behaviour accordingly.

The availability of smart phones capable of running apps (specialised 'applications) has led to the development of new measures of well-being that are based on the individual inputting information on location, the way that they feel and their interactions with others. The smartphone can provide additional context automatically, including location, the number of conversations, the distance travelled, and external parameters such as the weather and the temperature. This supports the idea of a life that can be measured in a sensitive manner, many times a day and without being seen as intrusive. This leads to the concept of the **Quantified Self**.

Knowing how one feels and how one lives in a way that can be measured and easily compared with other people can have both benefits and disadvantages. The benefits to society mainly stem from an ability to identify people who are unhealthy both with respect to acute needs and, from a predictive point of view, those who are likely to be unwell at some time in the future. In the mental health space, people who have bipolar disorder can be monitored and supported more efficiently, perhaps leading to a reduction in self-harm and suicide.

There are likely to be some people who rebel against the need for measuring their own condition daily and for ever. They could view the measurement regime as being a restriction on their own lives, preventing them from doing what they want to do because of the need to compete with their own measurements. This could lead them to walk away from treatment regimes, resulting in a sudden decline in their well-being.

2.6 Social networks

Social capital[1] refers to the collective or economic benefits derived from cooperation between individuals and groups and highlights the importance of social networks that link family, friends, neighbours and communities. Wellbeing can be affected by connectivity: people who have low social capital are likely to be lonely but also are more likely to reject public health initiatives such as flu jabs which could be beneficial to their health and well-being.

The number of older people who live alone has been increasing for many decades. By 2025, two out of every five older people are likely to live alone. Their quality of life may depend on them being able to build strong social networks. Traditionally these networks were built

[1] 'Just as a screwdriver (physical capital) or a university education (cultural capital or human capital) can increase productivity (both individual and collective), so do social contacts affect the productivity of individuals and groups' http://en.wikipedia.org/wiki/Social_capital

on neighbourhoods, clubs and pubs, and religious groups. Meetings became social events and absence either signified a rejection of the group or a trigger for other members to begin to visit. But what happens when a network starts to disintegrate because of death or geographic dispersal or because the individual loses physical capacity? Can web-based social networks compensate by nullifying geographic separation or by building new networks?

Skype, arguably, demonstrates that 'geography is history' by making possible free, real time video communication with family and friends thousands miles and continents apart. The barrier of course is being able to afford a computer and a broadband connection, which may limit use by lower socio-economic groups. However, its potential as a support mechanism should not be underestimated: the technology is simple and it works; we need only the social, economic and political will to make it happen. In Scotland older people enjoy free bus travel: why not free broadband?

Social networks such as Friends Reunited and, more significantly, Facebook, have emerged as vehicles that can not only link friends together but can also become a means of appealing for associations and linkages that can be supported by the sharing of personal information.

The inclusion of a camera on smartphones makes it easy to share photographs which can enrich communication. For example, proud parents may announce the arrival of a new baby with a picture that everyone might wish to see. On the other hand employers might also see evidence of why someone who has phoned in sick is unavailable for work on a particular day. Being aware of and able to set privacy levels is therefore important in order to control who can see your personal information and news: young people and vulnerable adults in particular may admit more people as 'friends' (or connections) than might be advisable.

The lifetime of major social networks is likely to be limited to a few years as new business models emerge and new promotional strategies offer benefits to subscribers. This may offer an opportunity for new networks to be created to deal specifically with those people who are excluded in any way, including those who will be referred to social services for assessment and support.

2.7 Entertainment

Many people still remember the coronation of Queen Elizabeth in 1953 being shown live on television. This was an important milestone in establishing this new medium as a competitor to radio and the cinema as a source of entertainment. The arrival of colour TV in the late 1960s contributed to the declining popularity of cinemas and theatres, many of which closed.

Today, many homes have a TV in every room and technology has advanced to deliver high definition and 3D pictures on very large screens or 'home cinemas' with surround sound.

Paradoxically perhaps, radio is more popular than ever and cinema has bounced back from decline to once again become an important element in the social lives of many people.

Video images, still or moving, can be displayed also on laptops, tablet devices and smartphones which means that people can be entertained or informed on the move. Some train operators have followed airlines in providing an 'at seat' entertainment experience which can be offered with certain choices, though many passengers prefer to use their own devices and content. In the future, it seems likely that access to both audio and video entertainment will be possible at any location and in a way that doesn't interfere with the environment of other passengers.

For those who want neither video nor audio (e.g. music) entertainment, reading may remain the entertainment of choice. Many older people have struggled to find suitable reading materials as a result of the closure of local public and mobile libraries. Some people cannot support the weight of a book while others lack the dexterity to turn the pages. Others have sight problems which prevent them from reading small print. All these problems can be overcome using either text to speech technologies (which are replacing talking books), or by using e-reader devices which allow font sizes to be increased easily and which offer simple interfacing for moving pages backwards or forwards.

In the future, it must be assumed that all entertainment media will be held in the 'cloud[2]' and will be downloadable to an appropriate device on payment of a fee provided that a communications contract is in place.

The pre-requisites will be

- A device (eg PC, laptop, tablet, Kindle)
- A contract with a telecoms provider (eg BT, Virgin, Sky) for broadband
- A contract or contracts with media provider(s), (eg Netflix, iTunes).

Those who lack any of these components may be entertainment excluded.

2.8 Cash and money

Cash has been king since the abolition of the gold standard. It is an expensive method of transferring money between people and organisations and is a considerable overhead for industry and for individuals travelling between different countries. The highest denominations are lightweight and easily lost, stolen or destroyed while the smallest denominations are heavy, dirty and difficult to handle. It is surprising that physical cash continues to be used. It can only be a matter of time before it is digitised and replaced by virtual cash.

[2] This means the material (book, film or whatever) is stored in a remote computer (the cloud) and downloaded (or 'streamed') to your device on demand and possibly only temporarily.

Large payments were previously made by cheque. They are expensive to process by the banks because people can write them by hand which makes them difficult to read electronically and automatically. Consequently, they require human intervention and this is not what modern banks wish to do, so they want to promote greater use of debit and credit cards. The latter were used initially as a cheque guarantee but are now being used almost exclusively as a means of withdrawing cash from ATMs and for making payments electronically. UK banks wanted to do away with cheques by mid-2012 but they had to perform a u-turn under pressure from charities representing older people. It is apparent that digital cheques and other cheque-replacement strategies will be introduced soon that satisfy the most pressing concerns of older people.

It was difficult to see how cash could be replaced for payments for lower cost items such as newspapers and sweets until the era of contactless payments. Near field communication systems are likely to replace bar-codes to carry product identification information. They can be read by electronic receivers. The same technology can be two-directional, allowing information to be passed from a smart phone to a reader and back again. The smart phone effectively becomes a wallet which can be digitally filled by the owner, and then emptied when making purchases. For small sums of money this approach is ideal and is likely to be rolled out. If cash disappears then begging will become difficult and welfare payments made on a card. Such cards are already used by social services as a means of providing claimants with a means of receiving self directed care and support. By restricting use of the card to outlets that can provide care and support services, opportunities for spending the cash inappropriately are restricted.

It follows that many users of social services will need to have a smart phone as well as a card that can be used to buy services. In the future, smart phones may be provided as a loan item to claimants for social care. This could include a digital wallet facility, as well as the communications and information ecosystem that would allow these people to receive a whole range of other services that would prevent their social exclusion and which could be used directly to provide them with information and access to entertainment.

2.9 Biometrics and fraud prevention

Identity theft is used by criminals to pretend to be someone else in order to access resources or obtain credit and other benefits in that person's name. Although the concept has been around for centuries, it is a growing concern in the digital world as we acquire multiple online identities: for bank accounts, social networks and using public services such as paying tax, electoral registration etc.

Passwords are fraught with difficulty: typically they are hard for humans to remember and easy for machines to crack. Efforts are therefore focused on other forms of proving identity, for example:

- **Fingerprints** have been accepted for over two thousand years to confirm identity, mostly in criminal justice. The technique has been applied to door-lock opening in some supported housing schemes. There are practical problems associated with registering 'allowed' fingerprints and the useful lifetime of such products is also only about three or four years.
- **Retinal imaging** and **DNA** analysis have been relatively slow to follow, but only due to the sophistication required for measurements, and the time taken for testing. A combination of retinal imaging with facial gestures and blinking is possible in the lab but currently takes half a minute to achieve a match - and this is achieved only with the use of considerable computer processing power. This sort of time makes applications in mass people transfer impossible.

Current research in this area is focusing on the uniqueness of other body parts such as **ears** and **knees** as biometric indicators. The ears have great potential because they are usually exposed, though hidden sometimes behind hair and other times by hats and other clothing. On the other hand, the knees are rarely visible and however unique they may be, there will be cultural and religious obstacles to overcome before scanning could become a regular part of identity confirmation. The cameras which are central to such systems used to be expensive but, as the cost of high quality cameras continues to fall (there is one in nearly every mobile phone), it becomes feasible to devise identification devices that use multiple cameras to simultaneously recognise the eye and the ear.

Movement analysis can be used to identify people by their walk: gait and other biorhythms provide unique signatures. It is possible to learn someone else's gait though, and injury or illness can have a temporary effect on gait.

Over the next ten years, with more sophisticated databases and image processing facilities, the cost of implementing advanced biometrics will fall, enabling their application across more diverse areas and in more social opportunities. Potentially, cameras will use cloud-technologies to provide individuals with instant recognition of anyone approaching them in the street. This could prompt a name or the occasion when they were last seen or spoken to as a secondary method of control in much the same way as Internet banking seeks to avoid fraud. **This has the potential to remove the need for passwords and might then be the basis of machine-based communication either in front of a laptop or tablet device or when using a smart phone**.

There will need to be special measures introduced to support people with any form of disability as they might well have one or more sensory deficits. Similarly, people may struggle to communicate following a stroke or a serious accident. Nevertheless, it may be reasonable to conclude that such systems will be both available and acceptable within the next 10 to 12 years.

2.10 Health information

Health records in the form of written documents, x-ray images and clinical observations are an important means of making all interventions efficient and safe. Increasingly people have many different conditions (comorbidities) and may be treated by several specialists. As these physical records are moved, inevitably some get lost: estimates suggest that one in three records is 'lost' at any one time.

The best resource for information about a patient is his or her primary care record which is held by the GP. The UK was an early adopter of electronic primary care records and can be proud of the way that these have enabled population-based information to be collected and analysed. Scotland (and to a lesser extent Wales) has led the way in ensuring that all these records are accessible through anonymised approaches that allow researchers to examine trends and improve analysis of performance. Fundamental to this has been the allocation of a unique identifier. At the same time, individuals can access these records both to check for accuracy and to see what their doctor has said about them.

This has the potential to make people more responsible for their own conditions, and might lead to better self-care and changes in behaviour that might reduce the incidence or severity of chronic conditions that are related to lifestyle.

In the future, we can expect the primary electronic health record to be linked with hospital administration systems, picture archiving systems and other records held by hospitals so that appropriate medical staff can have access to all relevant data.

When the social care record is added to the mix, then this will mean fewer but shorter and better assessments for social workers and for healthcare staff. They will know circumstances and factors that could influence the choice of approaches. This supports the idea of there being only one record consisting of several components, all of which are accessible by an appropriate professional at any time and in any place.

The ambitions described above are not limited by technology: most of the interoperability issues between rival commercial record systems have been resolved and database providers are being compelled to support joint working. The English NHS Mandate requires Trusts to effectively replicate arrangements already in place in Scotland and in Wales and this will go a long way towards achieving a genuinely paperless NHS well before 2020. With new biometric identification technologies, individual records will be available to out-of-hours physicians and to those working in an A&E department irrespective of the consciousness state of a patient.

New telecare and telehealth technologies will produce significant more volumes of data which are currently held in different places and owned by different organisations, rarely the patient. These data will also need to be shared, but only in a manner that is acceptable to everyone. Patients may not want all their mental health information published in a form that can be viewed by social workers. GPs may not want to have access to all the data that might suggest that there is a domestic crisis to which they had neither the wish nor capacity

to respond. Monitoring systems that support the '**quantified self**' may also offer data that may, or may not, be added to the full record.
The future of health information might therefore be about providing individuals with the means of producing relevant information, storing it somewhere secure, and then viewing it at a later time but in a format (or with advice) that is acceptable.

See also http://mydex.org/ 'Mydex gives individuals back control over their personal data'

(see also Digital Scotland 2020: Achieving World-Class digital infrastructure: a final report to the Scottish Government http://www.scotland.gov.uk/Publications/2013/02/9054 'connectivity by any device, anywhere and anytime')

2.11 The Future of Healthcare

The strains on our healthcare delivery system are becoming greater, as they are in other developed countries, as a result of an aging population, rising expectations and unhealthy lifestyles. The necessary changes will require a **significant shift in resources from secondary care, where unit costs are high, to community care** where people can generally be treated at home.

The future must therefore necessarily involve efficiencies in hospitals and in the way that people can be treated in less expensive locations, ultimately in their own homes. Hospitals will use more sophisticated diagnostic tools including scanners of all types to non-invasively probe inside people's bodies. This will result in more day cases and hospital stays (already averaging under a week) to even shorter periods with on-going support provided in intermediate care settings that might include hotels, care homes or the person's own home if it is clean, safe, secure and has all the necessary amenities (include access to the Internet).

Advances in medical technology will allow more treatments to be delivered in the home. This will mean fewer visits by clinical staff and fewer opportunities to attend primary care centres. Pharmacists will become suppliers of information as well as drugs, so the balance of care will shift significantly away from doctors who will work in different ways, relying increasingly on telemedicine to bring the specialist to the patient for an online consultation. For example, if a patient complains of nausea and severe headaches, a virtual consultation can be offered almost immediately and without having to send a patient with a potentially serious and acute condition on a potentially long journey to a hospital.

In the above example, a neurologist may ask further questions as well as conduct a complete neurological examination using videoconferencing technology. Airedale General Hospital consultants have new contracts that require them all to be available for virtual consultations. The first benefit has been in reducing the need for prisoners at local jails to be brought into A&E (which may need to be locked down depending on the circumstances and the potential for violence of the individuals involved), potentially saving hundreds of

pounds in security costs. It also avoids the need for healthcare staff to have to go into a prison environment.

The principles described above are already saving lives through telestroke services which lead to more people being thrombolysed appropriately and avoiding long term support that often follows a stroke incident. Teledermatology has been practised for a number of years and results in rapid diagnosis and resolution of problems that previously required significant time for remedy.

2.12 Gadgets and DIY healthcare

There are at least three elements to healthcare:

- Gathering information on symptoms and physiological parameters
- Interpreting the information; and
- Responding to the diagnosis with treatment.

Many people choose to exercise self-care because this gives them control whilst avoiding the need to share their concerns and personal details with others. A 'do It yourself' approach might even be encouraged by the NHS as a viable way of using scare resources.

Medical devices that monitor vital signs are mature and have been miniaturised so that they can be used in the home by individuals with little or no medical training. Indeed, blood sugar monitors are being produced specifically for use outside the hospital and in such a way that they can be used reliably by people, with advice and training being provided online via YouTube.

Many medical monitoring devices do no more than produce a single measure which the user may record or respond to. Others link wirelessly to smart phones allowing data to be stored and entered into a personal health record where trending opportunities existing. Indeed, individuals can easily enter their data into an app running on their laptop, tablet or smart phone. This trending information may be useful for self-care and could be passed on to a physician, though the volume of data produced in this way, and doubts about the quality of the data, are likely to persuade GPs to discount data produced in this way.

This gap in knowledge can be filled with advice, information and diagnosis that can be obtained online using a 'Doctor Google' approach. The quality of such diagnosis may vary significantly, although there are many sources of information that are both supported and approved by the NHS (and by similar sources in other countries). However, with a data-rich approach, and a choice of diagnosis, people may be empowered to take a greater role in healthcare.

The final component for the DIY enthusiast is the treatment option. Many people fear long term use of medication produced by the big pharmaceutical industry and prefer more natural remedies which are available over the counter. More medical treatment devices are available that stimulate blood flow and counter pain through the use of electrical and physical stimulation.

The evidence may be weak at present but might grow as more people use them and as their cost drops. **The impact of such technologies on vulnerable people is difficult to gauge**.

2.13 Telecare

Support provided at a distance to people in their own homes is known as **telecare**. The name implies remote monitoring and interaction, and includes the monitoring of the home environment and of the individual, as well as the interaction of the individual with this environment. Definitions have become difficult due to some US medical device manufacturers introducing the term telehealth to describe medical telecare such as remote measurement and collection of vital signs data.

In the UK, telecare alarm services have matured quickly using the robust platform and infrastructure of social alarm systems which were originally used by tenants in sheltered housing schemes to seek help when they didn't own a telephone. The majority of telecare service users today live in their own homes and use dispersed alarm units to link with a monitoring centre through the telephone network. Improved assessments of needs and risks to independence have resulted in combinations of sensors being used to support the option of staying put rather than moving into residential care or having increasing levels of domiciliary support. They support the policy of bringing care closer to home and of encouraging people to become partners in their long term support arrangements.

Telecare services developments over the past decade include standalone items such as automatic lights which have achieved significant efficiencies, especially for people who are frail and prone to falling, and to those suffering from mild cognitive impairment, epilepsy and anxiety. People who have long term conditions, including chronic conditions such as diabetes and hypertension, can also be managed more effectively through telecare support. The benefits of telecare services include a relief of stress for family caregivers, enabling them to continue to provide unpaid support while holding down a job and maintaining their quality of life.

New developments enable continuous monitoring of behaviour and smart devices that can, for example, remotely control the cooker, the water supply and door entry. Such monitoring may detect incidents early and prevent emergencies arising. Devices are becoming smaller and easier to embed quickly within the home environment, making them more acceptable and less noticeable. Longer battery life means less frequent maintenance visits.

The monitoring centre becomes an information hub, offering both advice and a vehicle for checking that someone is coping, especially following a trigger event such as a stay in hospital or the illness of an informal carer.

New systems utilise web technology that allows family members to be more proactive in the monitoring of their relatives. This can lead to greater interaction with them, especially when the relatives live a considerable distance away (perhaps in another country). These next generation systems might include video conferencing and the use of tablets, smart phones or smart TVs, but when an emergency response is required (perhaps to lift someone up after a non-injurious fall) there remains a need for human intervention.

The future of telecare might therefore include an increasing dependence on volunteers from the community to provide the required support. **Social networking may need to be used to support telecare technologies.**

2.14 Mobile healthcare

While telecare can support people effectively in their own homes, it is now recognised that being able to go out to enjoy open spaces and to overcome the fear that the home is a prison is an important part of improving well being and supporting a higher quality of life. Extending telecare technologies to operate outside the home is known as mobile healthcare (or mCare) and is based on mobile telephone networks rather than landlines.

The simplest form of mCare requires only a basic mobile phone to deliver telephone calls, voice messages and SMS (text messages). The technology is mature and there are countless applications in use both in the UK and in developing countries such as Africa and India where mobile telephones have already achieved a saturation level and where fixed telephone infrastructures are not likely to be established at any time. Such telephones are universally available in the UK and are used by the vast majority of people including many older people, especially if they have been introduced to the low cost (£30) devices that have large buttons, large displays and a separate large button for calling an emergency number.

Smart phones are rapidly replacing basic phones and allow the use of a large range of 'apps' that are being developed to provide information and for enhanced experiences. In the healthcare space, Skype, FaceTime, Vidyo, and GoToMeeting with HD Faces are all current examples of video conferencing software available on tablets and smartphones.

The specific software will depend on the nature of the communication desired:

- Skype will manage a simple video phone call
- Where an A&E physician needs to share a CT scan of head with a Neurologist on call from home, GoToMeeting would be more appropriate

- If the physician would rather have a dedicated, online meeting room that patients and colleagues can simply drop in for a virtual meeting, a Vidyo virtual room may be more appropriate.

This technology can suit any form of lifestyle, including many people with complex needs whose lifestyle is not consistent with a fixed address.

Social care apps are available already to deal with problems of sensory deficit:

- Guiding a blind person through GPS navigation and reading signs through apps linked to the device's camera
- The microphone can be used as a hearing aid
- Speech recognition software can be used either to replay speech at a slower speed or for translation into a language of choice
- Speech can also be selected for people who have a stammer or who have a problem with their larynx
- Apps are becoming contextually aware, recognising situations and locations, and are thus becoming a personal assistant for people with disabilities.

By 2020 it is therefore possible that a smartphone may be prescribed for people who need social care, together with a range of apps that have been selected to meet their assessed needs.

Whilst smart phones, tablet devices and apps may become an important part of an individual's personal support armoury, the potential of mCare will be limited only by an individual's ability to make use of all its functions. Each device could become a part of an individual's personality, supporting them to improve behaviour, take exercise, avoid temptation and manage their own health and well-being. Potentially, mCare could become the most important element of social care and support within 10 years.

2.15 Artificial Sensing and Enhancement Devices

- It is estimated that one in seven people has imperfect hearing
- The numbers who are born deaf are quite small, and many of these people may have some form of hearing restored through surgery or through technology
- Similarly, while there may be nearly a million people registered as blind or having a severe visual impairment, the vast majority lose their sight during their lives as a result of disease
- New treatments will deliver sight recovery or restoration over the course of the next 10 to 20 years.

Fortunately, technology can provide excellent sensing capabilities that are already providing people with external portable devices for enhancing their lives. The simple **hearing aid** is an excellent example of a device which has been improved through both miniaturisation,

personalisation and enhanced performance. Today digital hearing aids use sub-miniature microphones that can be unidirectional or omnidirectional and which can be adjusted in sensitivity over an extended range. Tomorrow's devices can be switched between modes by the user so that they can benefit from hearing perfectly in any environment. Indeed, they can be used with adaptive filtering technologies (as used by helicopter pilot headsets) to eliminate some sounds so that the rich speech (or music) components alone remain. Future developments will be on optimising control so that the user can switch seamlessly between different amplification applications without appearing to be distracted. A smart phone or mp3 music player may be used as either a processing unit or as a ubiquitous output device that looks cool and natural.

These same technologies will also be developed for use within the home environment for times when a deaf user isn't present or is asleep. **Acoustic signatures** associated with adverse events and incidents such as the hiss of a gas leak, the crackle of a fire, the sound of a smoke detector, the drip or a water leak, or the sound of breaking glass, can be directly associated with programmed actions. Speech will be recognised, interpreted, translated, simplified or displayed so that an individual knows what is said and can be provided with clear instructions on how to respond.

Video cameras have become smaller and cheaper and capable of producing high definition images. The problem of storing and editing these large image files is being solved by the arrival of **cloud computing**.

Electronic noses are already capable of detecting the quality of wine and fresh fruit. Similar technology will be based in smart phones and will be able to analyse the air to **warn of food that is no longer fresh** and of other indicators of danger including **gases that have little natural smell**. **These devices could support people with cognitive impairment - whose sense of smell tends to deteriorate - to live independently.**

Many older and vulnerable people are at risk of **hypothermia** during the winter. Sensor devices can provide warnings of low temperature. In the same way, **heat stress** can be a danger during the summer months so sensors can alert people of the need to open windows or to operate a fan.
Finally, people who have **damaged their fingers or hands** will be able to wear sensors embedded in artificial skin or in gloves that will enable them to identify textures and shapes and be able to dress and undress without the assistance of carers.

2.16 Robotics

We may recoil at the idea of personal care being delivered by robotic devices, but it is likely that within a decade, personal assistants will exist to assist with household tasks. These are unlikely to be humanoid and are more likely to be machines dedicated to helping frail people to support their own weight and to carry trays of food around the home.

There are four broad classes of robot under development that are likely to mature within 10 to 12 years.

1. Miniature industrial robots that have been programmed to perform specific tasks with precision. They are likely to be relatively heavy, enabling them to bear weight but still have the necessary flexibility to carry an individual over short distances, placing them in a chair or on a bed. They will have sensors and cameras to provide immediate feedback and to adjust rapidly in response to verbal commands or cues from the user. Some designs may build on existing assistive devices such as a bathroom hoist or a bathing aid to become intelligent extensions of products already on the market. A stair lift with intelligence is already being designed by a UK company and is aimed at providing the user with more control of the journey between floors of a house.
2. The second group of devices might be described as intelligent furniture. Beds and chairs are already available that adjust to make the user more comfortable and also to help them get into or out of bed. The control units are fairly cumbersome and are suited to operation by a carer. Voice activated controls and built-in intelligence will give the user more control and independence. Other items of furniture to which intelligence might be added would be tables whose height can adjust and which hold items of food and medicine securely. The table would recognise these objects and could provide prompts or reminders.
3. Mobile robots form the third group. These could be goffers that can either fetch and carry items such as newspapers, drinks or trays or which can accompany the user when they move between rooms providing them with support or prompts. This type of robot could be an intelligent walking frame with wheels which could double up as a smart wheelchair when necessary.
4. Finally, there are companion robots. These might be in the form of an electronic pet, typically a cat or a dog though the Japanese Paro robot is a seal. Pets can respond to stroking and being patted; they can also remind their owners that they need to take exercise and to eat, drink and take their medication. Various designs are already available which provide feedback, but future models would include cameras and a screen to provide a mobile means of information and interaction with other people over the Internet. Intelligence within the device could allow them to have a personality of their own and gain knowledge by scraping data from websites so that they can generate speech and have conversations about the news, the weather or sports results.

2.17 Transport and transfer technologies

Walking is good exercise and is a no-cost form of transport that is encouraged because of its impact on well-being. For an individual with a chronic disability, or suffering from the effects of an accident or an injury, this becomes impractical without an assistive technology (AT). A walking stick is the simplest example of AT.

Within the home, the stair lift has enabled people who live in conventional properties that are on two or more floors to continue to use facilities on different floors when climbing the stairs has become too difficult. This is often the case for people who have arthritis, a lower limb amputation, a long term condition such as Chronic Obstructive Pulmonary Disease or people approaching the end of life and who have chosen to die in their own homes.

Designs have improved so that a curved staircase is no longer an issue, and the reliability has reached a level where breakdown is a rare occurrence. Through-floor lifts have been an alternative proposition but they remain too large for most properties. Alternative approaches may emerge using air pressure or water pressure as the driving force. A Brazilian design already utilises a plastic tube in which a pod is moved effortlessly up and down.

Electronic wheelchairs are now available that allow the individual to become more independent as they allow the user to control both propulsion and steering. Some models have the capability of mounting a pavement or a step or even a flight of stairs. Personal muscle amplification devices have been developed, originally with the intention of helping people who are confined to a wheelchair due to a neurological disorder, to perform some tasks from a standing position. Indeed, the Rex walker's manufacturers claim that anyone who can propel themselves in a wheelchair could walk by using Rex.

Other approaches have focused on the rehabilitation of people after major accidents that have caused partial paralysis. They quickly extend into exoskeleton designs that enable anyone to gain a mechanical advantage and, thus, to tackle physical tasks that would not otherwise be possible. These suits are the focus of major research projects across the world. Some products, such as the system developed by Honda, are being tested in Assisted Living facilities and are likely to become more and more enabling over the next decade.

Similar benefits are also occurring outside the home with a number of novel carrying systems appearing over the past few years. They are generally termed 'scooters' but this covers a wide range of systems and devices ranging from the Segway, a device that is a mobile platform on which the user stands and navigates, through to conventional electric vehicles that have been developed from golf buggies. There remain a number of issues concerning their use on roads or on pavements, but similar problems will need to be resolved for bicycles to play their full part in enabling people to get more exercise. The potential for hybrid scooters remains.

2.18 Smart domestic appliances and personal hygiene

The bathroom is a dangerous place and one where many older and disabled people slip and suffer a fall. Many older people recall taking a bath in a tin tub in front of an open fire. Today, the options tend to be a level access shower (i.e. a type of wet room) for anyone unable to get into a bath. There are various aids to help people get into and out of the bath, most involving a seat that can be raised or lower, with some bath-tubs having a door.

There has been some research into alternative methods of keeping the body clean. Sanyo introduced a machine in 1970 modelled on a clothes or dish washing machines: the person sits on a seat inside the machine where they are cleaned by a set of water jets. These have not proved popular and, furthermore, require the individual to be transported to the machine. Thus, the technology may find application in nursing homes but are unlikely to be attractive to people living independently in the community.

The washing needs of people change over time. Over the past 20 years, body piercings have appeared which have demanded additional attention to avoid the problems associated with poor hygiene and metals. Similarly, hair may be permed and dyed using chemicals which are much stronger and which might damage the hair. Add to this the painting of finger and toe nails and the washing needs are rather different to what they might have been even ten years ago. Finally, tattoos were once popular only with sailors. Today, they are likely to be found on the arms, backs and legs of both men and women. New ways of cleaning these tattoos will be needed, especially if they become infected or are sites at which pressure sores develop.

Even if a person's body is clean, if their clothes are dirty they may become socially isolated. But the washing of clothes can be strenuous even if a launderette is used. The need to conserve water has driven research into ultrasound techniques to beat the dirt out of clothing while some companies are experimenting with polymer chips. **These "green" technologies are quickly maturing and are likely to be standard in the next 10 years.**

Other smart household appliances are already appearing on the market and may soon become common in UK homes.

- Robovac devices have sensors to enable them to detect dirt on carpets and to adjust their operation accordingly.
- Refrigerators can read bar codes or RFID tags to identify their contents and their "use by" dates, enabling them to inform the owner that they should use the products before they are out of date. They can be linked to the Internet to reorder items as they are consumed or to suggest menu options for the individual based on their preferences or according to the diet required to manage a condition.
- Ovens will automatically switch off if they are left without attention for too long, and drying machines will set times automatically.

Devices may be linked so that they are more efficient, and report maintenance issues so that they can be repaired (perhaps remotely) before they suffer a catastrophic breakdown.

2.19 Personal and home security

It might appear perverse, but people with very little personal wealth and property are more likely to be the victims of crime than those who have expensive items. This may be due to where poorer people tend to live or because people who have valuable assets take greater

steps to protect them. There can be no doubt that crime has a very negative effect on individuals and on their families, creating a fear factor that may be difficult to remove. The impact on quality of life is therefore very considerable, especially if it forces people to stay at home behind locked doors, effectively isolating themselves from society.

Modern policing places increasing reliance on the use of closed circuit television (CCTV). Town centres are covered by cameras, used increasingly in the fight against crime by both detecting anti-social incidents and identifying the people involved. They are also used to monitor the movement of cars that may be involved in incidents of burglary and violence and are fast becoming the primary mechanism of law enforcement agencies to solve crime.

CCTV has moved into the home to record movement, but monitoring the footage is time consuming and often not practical. Cameras are now available which provide an instant video feed to a smart phone when movement is detected. These may have intercom capability, allowing someone to remotely speak to an intruder sometimes before they have gained access to a building. This may serve as a deterrent and, when fitted alongside simple devices that switch lights on randomly around the home, may force burglars to go elsewhere.

As the price of cameras continues to fall, the option of carrying a camera on the body that continuously monitors personal space is becoming more useful. Using wireless networks, the data collected can be sent continuously to the cloud for safe storage. It can subsequently be retrieved to provide evidence (video and audio) of confrontations enabling successful prosecutions to be made. The smart phone itself is becoming a valuable item that is attractive to criminals. These can be tethered to personal attack buttons using wireless technology allowing the device to be activated by the pressing of a button if the owner is being attacked. The phones can then be tracked and located by the police while being rendered useless to the assailant.

Bogus callers are a perennial problem for vulnerable people. Video door bells can be configured to display images and record the words of visitors before they are admitted, allowing remote monitoring centres to oversee the situations and use image recognition software to confirm the bona fide of visitors. **Such arrangements may become commonplace over the next five or six years, significantly improving the safety of people living independently.**

2.20 Personal safety

The biggest risks to personal safety stem from fires and falls. Most fires are the result of poor cooking practices resulting in burns or scalds. Floods and gas emissions are caused by a failure to remember to close taps.

The current approach involves detection of an emergency situation as soon as possible, but always after a problem has already occurred. This responsive approach can minimise the risks provided that there is a protocol in place for intervening. This could increasingly be an

automated response such as the switching off of the gas, of water or the switching on of a sprinkler system or a water mist system.

In the future, monitoring systems will be more sophisticated and will have sensors and local intelligence to identify activities. In this way, reminders can be issued before an emergency occurs. **This 'smart kitchen' approach may become an integral part of homes of vulnerable people**.

A prototype system has been developed at the Culture Lab in Newcastle. Sensors have been embedded into cooking utensils enabling the kitchen to identify what the person is trying to cook or prepare. It can provide interventions as messages on an instruction screen.

Accidents also occur out of doors. People with dementia might become lost and may have poor road safety awareness. Location devices based on GPS have advanced from large and heavy receivers that were used on ships and boats to small battery-operated devices that can be carried in the hand or in a handbag. The current generation of locators has limited battery life and are rather too large to be secreted about a person's clothing, while devices that are integrated into a wrist-watch are rather clunky and unattractive.

Within 10 years, the technologies will have matured and will be much smaller so that they can be embedded in shoes, in walking sticks, hats or any other item of clothing. Power requirements will have reduced so that energy harvesting from the movements of the individual will be sufficient to keep these products working for several weeks without the need for recharging. The devices will not simply indicate to others where the individual happens to be, but will provide subtle guidance cues to direct them home.

Cameras might also form part of the personal security systems that will protect people from accidents. Data may be sent to the cloud and analysed in real time if the person is in a dangerous location, and can provide prompts either to the individual or broadcast advice to others to clear the danger. These systems may be embedded in items of clothing (such as a hat) or they may be attached to spectacles.

2.21 Energy and portable power supplies

The demands of developing economies for more power will inevitably lead to higher domestic fuel charges in the UK, especially as oil and gas reserves dwindle.

By 2018, UK homes should be fitted with new smart meters. The specifications for these devices have yet to be finalised, but will include a means of identifying wasteful use of energy including TV sets that are left on and unattended, fridges and freezers that are set at too low temperatures, and dryers that are used for too long or when the weather is suitable for using a washing line. They could be an enabling factor that supports changes in behaviour driven by a need to use less power, but it is unlikely that they will offer a big reduction in costs that are already a problem for many vulnerable families.

More generally, the need for power conservation will include devices that are more efficient, and a significant emphasis on heat retention in buildings through better insulation.

The energy crisis may force many people to spend more time in community settings, including shops and public buildings where they can benefit from the warmth. Increasing reliance on mobile communication devices will lead to increasing demand for battery charging facilities.

Greater use may be made of portable devices for generating power based on solar cells, wind or hand motion.

2.22 Smart cities and homes

The Digital City initiatives have been based on information and how it can be used most effectively to make people aware of what is going on around them. This means better coordination of resources, more rapid access to advice and a battery of sensors measuring every conceivable parameter from sound and light levels through to air quality and temperature fluctuations. There are several Digital or Smart City initiatives currently being implemented, both in the UK and across the world. They may significantly impact the lives of the millions of people living in them but the timeframe for outcome benefits to influence planning and design elsewhere is likely to be at least 20 years, and therefore outside the timeframe of the current project.

Housing plays a big role in the lives of most people, both through their aspirations to move up in the world (usually to a bigger property with a garden) and as the heart of the family life which is associated with good quality of life. UK properties have a life span approaching 100 years, which is about double that of their European counterparts (and certainly longer than the wooden-frame buildings built in North America for example). A shortage of houses has plagued improvements in social welfare for the past 30 years. There is an argument that there are enough houses but the wrong size and in the wrong places, and this has some basis in fact as demography changes lead to more people (and more older people) living alone. However, if there are two million homes in Scotland, each with a lifespan of 100 years, then the renewal rate needs only to be 20,000 per annum to maintain the status quo. However, it must be clear that the impact of smart house development will be small. The focus should therefore be on adapting existing properties to render them more appropriate for vulnerable people.

Housing adaptations are a branch of assistive technologies. The technologies for providing different forms of accessible bath and level access shower are well-established, with little research considering anything other than alternative building materials and methods for maintaining the temperature of the bathwater. Different technologies for bathing will be considered separately.

Thus, housing technologies are not likely to impact on social work within the next 20 years, though the use of information technology to ensure that people are aware of what is available is likely to be commonplace well before then.

3 BEHAVIOUR AND ATTITUDE CHANGES DUE TO TECHNOLOGICAL ADVANCES

Technology is only one factor that will affect the way society changes in the next 10 or 15 years. This chapter will consider the context in which the technological developments outlined in the previous chapter will be supported (or held back) by societal factors.

When the impact of such factors has been considered, we can then apply these assumptions to a number of case studies listed in Appendix A.

The headings selected for this chapter are not arbitrary as they reflect the context in which technological changes must be considered. They must include consideration of factors such as demography and long-term conditions already addressed in the introduction to these papers, together with the aspects of workforce and citizenship considered in the parallel papers. The additional elements here focus on trends that are already occurring and which may leave people struggling with the changes that occur.

Finally, there is a need to consider the attitudes of people to technology generally, and especially to the issues of privacy and social responsibility that could be radically changed by technology. In some cases, public opinion will prevent some forms of technology being developed if not commercialised. In other cases, some technologies will be fast-tracked either at the request of government or because of a clear public demand for the opportunities that it can bring.

Predictions about the future must inevitably be subject to considerable uncertainty, but that is no reason to stop thinking what might happen.

3.1 The Welfare State

The UK can be rightly proud of the way that its welfare state has developed during the past 100 years to provide a safety net of financial support to people, and to their families, when they are unemployed, destitute, homeless or challenged by crises and emergencies. The range of benefits received is considerable; some are complex and many people struggle to understand their entitlements. Some are universal, some are discretionary, some apply only to parents, others to anyone.

The total cost of providing these benefits continues to rise and, when the economy is stagnating, there is inevitably both political pressure, often supported by popular public opinion, to introduce welfare reform so that people who do not work cannot be better off than they would be if they were in full-time employment. This strategy requires a universal benefit to be introduced so that it is easier for claimants to access support but also easier for agencies to identify the total benefits received. The idea of a benefits cap then becomes

more practical to introduce, especially if all the processes involved in making a claim are handled electronically. Indeed, this encourages government to insist on applications for benefits to be made on-line. Unfortunately, this will marginalise those people who have neither a computer nor access to the internet, thus emphasising the digital divide in a manner which works against some of the most disadvantaged people in society.

There are currently few tangible links between digital technology and welfare provision. The most obvious are universal benefits such as a free television licence (worth £145.50) for everyone aged 75 or older, with blind and visually impaired people entitled to a 50% discount irrespective of their age. The significance of this position is that 6% of revenues generated through licence fees are to fund BBC on-line services such as websites and i-player. In Scotland, the BBC's Alba Gaelic language television service is predominantly funded by MG Alba, an organisation funded by the Scottish Government. It is therefore conceivable that in the future, licence fees may be used to directly subsidise access to information and advice through the Internet for vulnerable people, whether it is through broadband access or through a set-top box which removes the need for a computer in the home to access particular websites or to use e-mail services.

A second age-related benefit available in the UK is the winter fuel subsidy. People who receive certain benefits receive the payments automatically while others must make a claim. Those who are not eligible for benefit due to a lack of an address, for example, miss out on these payments and also on Cold Weather payments of £25 for each seven day period of very cold weather between 1 November and 31 March.

The development of new warm home initiatives plus the complex of subsidies that the electricity supply industry and government offer to people with solar cells further changes the economic arguments. Global warming may lead to greater variations in weather extremes but might also increase the amount of electricity that can be generated by alternative (green) sources such as wind and solar cells. It is estimated that energy consumption in the UK increased by 17% between Christmas and Easter 2013 compared to previous years as a result of cold weather, but the above subsidy scheme did not benefit older people because two of the seven day cold periods were after 31st March. It must be assumed that there will be more people living in fuel poverty in the future, and this will lead to more cases of cold related illness including influenza and stroke.

3.2 Management of long term conditions

The management of long term conditions will be improved for patients who are compliant with their medication regime, so it is possible that there may be compulsion to adhere to the prescription. Such compulsion may be monitored using technology. Indeed, the remote monitoring of vital signs using telehealthcare will become commonplace as the old boxes and sensors are replaced by devices that can be worn continuously or which can be embedded into the fabric of homes (including furniture and bedding) or can be worn as vests or patches. They will wirelessly transmit data to smartphones or tablets and mobile

transmission and cloud technology will enable real-time data collection, analysis and feedback.

One of the diseases which is projected to increase most significantly over the coming decade is Type 2 diabetes. Whilst there is a hereditary susceptibility to this condition for many people, including those from the Middle East and the Asian sub-continent, it is also a disease which tends to affect those people who are overweight and/or have a sedentary lifestyle. If untreated, diabetes can lead to dizziness and collapse at any time, but can also have more devastating long term consequences which include kidney failure, stroke, blindness and, in extreme cases, lower limb amputations. Management therefore includes daily monitoring of blood glucose levels and major dietary changes such as a significant reduction in the consumption of carbohydrates as well as a rigid exercise regime.

Many newly diagnosed diabetics follow this advice closely and can lead normal lives for 40 years or more, but some struggle to accept the change in lifestyle required, as well as remembering which foods are allowed and how much exercise they need to take. Individual support plans are now forthcoming and, over the next ten years, best practice will emerge in the form of smartphone apps that are personalised and which can become an individual's health coach. This level of support will be fine for some people, but others will need incentives, so it is likely that gaming technologies will be introduced, perhaps offering rewards for good compliance. There will be a temptation for some people to cheat, perhaps allowing others to perform exercise for them, or changing their consumption details.

Many of these opportunities for cheating will be removed through the use of a unique biometric identifier, a technology that will be mature enough to use in place of passwords on smartphones. However, the biggest challenge may be in encouraging older people to use the technology. Many older people have multiple morbidities. Indeed, a survey of Scottish patients implied that 42% of people aged over 80 will suffer from three long term conditions. It will be essential for those people to comply with treatment regimes if they are not to have the functional deficits that follow.

3.3 Finding people who don't fit

People who have low social capital are likely to have few relatives and friends with whom they regularly communicate, and are also unlikely to be part of community or faith organisations such as clubs, societies and church groups. They also die several years younger than most of the population, often because they don't engage with public health initiatives such as vaccinations against flu, regular checks on their blood pressure, blood sugar levels or, in the case of women, smear tests or mammography. The most likely reason for disappearing beneath the radar of such initiatives is their mobility which leads, almost inevitably, to them having no fixed abode and no fixed telephone line. It then becomes very difficult for them to be contacted because their mobile telephones are likely to have Pay-As-You-Go contracts that don't require validated names, addresses and bank accounts.

It follows that some of the most vulnerable people in society, including those who live on the streets, are effectively unknown to both the NHS and to social work departments until they are referred in a crisis. This could be an emergency presentation to a hospital Accident and Emergency Department where they will come into contact with a social worker because discharge may be unsafe. This often highlights the importance of the prevention agenda and the potential for avoiding admissions to hospital by intervening at an earlier stage.

The advantages of being able to locate people who are vulnerable to specific diseases will increase as genetic testing becomes more routine. It is already possible to determine who might be most at risk of breast cancer and prostate cancer as a result of family history. Add to this the evidence that particular diet and exposure to environmental factors can further increase risk, then it is evident that individuals can be identified and offered treatments that could save their lives, many years before they become ill. In the case of cancers, perhaps only the individual is involved, but for infectious diseases, it is the whole of society that is at risk if someone contracts one of the new strains of influenza or if someone chooses not to be vaccinated against rubella. In Chinese airports, all visitors are screened for fever and refused entry if they tested positive; in cities the public are monitored in the same way. Similar approaches may be necessary in the UK if potential carriers cannot otherwise be identified.

3.4 Volunteering

It is estimated that 72 per cent of people volunteered to perform a charitable act at least once during 2012, a rise from 65 per cent the previous year. About four out of every 10 volunteers offer their services formally to one or more organisations. The remainder volunteer informally by helping out a friend or a neighbour. Around 50 per cent volunteered at least once a month in the past year, up from 41 per cent on the previous year. Most have retired, many of them before the statutory retirement age. Those who don't feel able to offer time have offered their financial support at a time when the funding available from sources such as the National Lottery has been decreasing. Despite economic austerity, donations to charities have been increasing; 74 per cent said they had given to charity at least once in the previous month, up from 72 per cent the previous year.

Strikingly, 78 per cent of people strongly believe that they are part of their local neighbourhood, an increase from 70 per cent 10 years previously. Community cohesion is stronger than ever: 87 per cent of people believe their local area is a place where people from different backgrounds get on well together, compared to 80 per cent in 2003.

The role of volunteers in supporting vulnerable people is therefore likely to increase over the next decade, perhaps exploiting the success of the army of volunteers that was highly successful in London during the Olympic and Paralympic games. The greatest role for such volunteers may be in providing informal care for older people. Already the UK has some seven million informal carers whose value, in monetary terms, has been calculated to be

more than the combined budgets of the NHS and social care. Maintaining or extending this provision will help to support services in the future, and may be supported by technology.

Whilst there is ample evidence to suggest that telecare services support informal carers as much as (if not more than) the people that they are caring for, it is the potential for utilising the internet and apps to make their role easier to coordinate and, hence, more effective that is likely to be most successful moving forward.

Many of these focus on particular tasks that informal carers can help offer to older people such as organising their medication. A pillbox program is just one feature of an app called Balance. It also includes sections for caregiving tips, notes for the doctor and the patient's appointments, plus a 'learning section' with articles on aspects of Alzheimer's and an RSS feed for news about the disease. Tyze is another multi-functional app; it allows carers to:

- Organise appointments
- Plan outings
- Share stories
- Send updates to other family members

Another application is Rally Round which helps carers to organise someone to perform little jobs, often on a temporary basis, when someone has dementia, physical frailty, or is recovering from accident or illness. Similar applications are MeMaxi and Finerday.

3.5 The High Street

The shape and appearance of UK shopping centres have been changing for half a century. People complain that centres are losing their identity, with one town looking like every other both in terms of the stores and in terms of the layout. But there are three trends which are having a profound impact on many of the most vulnerable people in society:

- Centres lock their doors at 6pm or, in some cases, 10pm - thus denying people who suffer from claustrophobia from window shopping at times when other shoppers have left
- Out of town shopping malls - these US style centres are ideal for people in cars because they offer free parking which is essential for people who want to buy larger items, but difficult for people who have no transport and who must rely on public transport that is often deficient
- The rise of online shopping - which means that many potential shoppers only visit High Street stores to check the prices before returning home to make a purchase online.

It is the third of these effects that has the greatest potential for changing the High Street for ever, and it is making life for traditional retailers increasingly difficult at a time when high rents are crippling stores large and small. It is difficult to see how this trend is likely to change because consolidation in banking and estate agencies is already forcing the closure

of other High Street players, while additional pressures on pubs has led to the closure of thousands of pubs every year.

Those figures, however, demonstrate that consumers still value what the high street can offer - the chance to inspect what they're thinking of buying - as well as the new openness of the internet. Customer service makes a difference to people, especially if there is a problem and goods need to be returned. One of the most common reasons for furniture to be returned, for example, is that when a sofa or a wardrobe was delivered, it couldn't fit through the front door or up the stairs. In the future, people will be able to benefit from visualisation technology; they will upload the floor plans of their homes enabling the retailer to inform them of the problem before they try to delivery. Augmented reality view will similarly allow customers to see what a new item of furniture will look like in its intended place so that they can be more informed about the effect of size and colour.

In terms of improving the viability of the High Street, stores will have to focus on the importance of brand, which could mean that individual independent retailers will have to partner with national suppliers to support a local, tailored offering based on products that are designed for a more global market. This is a 'connected High Street' approach which could be enabled by the developments in internet availability and smart phone access described in the previous section.

The overall effect of all these changes could mean that town centres become smaller but more vibrant areas. They could thrive if people are attracted there in large numbers which means that retail must be developed alongside restaurants, pubs, galleries and other leisure opportunities. This is possible in new shopping centres which are already being integrated with transport hubs including railway and bus stations, but may be more of a design challenge for older towns and cities with large Victorian buildings. To ensure that more people are welcomed into the new centres, they should include attention to green spaces and areas where people can relax without feeling that they are second class citizens because they don't have the same buying power.

3.5 Privacy

To some people, privacy is their right to live their lives without interference; they may see the State as a potential 'Big Brother', spying on their every move and judging their actions and activities. Other people have fewer concerns about the role of the State, but great fear of individuals interfering with and invading their privacy. Some embrace the concept of 'my space', an area of a square metre or so into which nobody can enter without permission. This allows them to avoid physical contact and to feel safe from any form of threatening behaviour.

Yet this idea of private space, and its potential violation, is merely the tip of the iceberg as far as privacy is concerned; more significant is the idea of personal (and private) information being shared with anyone and everyone. This could be related to identity, opinion or image; for an individual who wants to remain anonymous or even secretive, this is going to become an increasing problem as technology provides the means of taking

photographs, recording conversations and capturing environment with something as small and ubiquitous as a mobile phone. The fact that this information can then be shared with the rest of the world using e-mail, Twitter, and Facebook makes the problem all the more difficult. So the threat is no longer solely from the long lenses of the Paparazzi but from anyone (and that means everyone!) who has even the most basic of mobile phones.

This relates to the changing views of society on what information should remain private, and what should be shared with others. The success of social media has been based on an attitude of 'sharing everything' with either your friends or the world. This has introduced a naïve idea in the minds of some younger people (especially those known as Millennials, i.e. aged 18-30) that everyone can be their friends, whilst perhaps failing to reinforce the bonds of genuine friendship with any form of test or restriction. Technology could play a role in defining these friendships and allowing individuals to understand what makes a good friend, but this approach has yet to be developed, and may be slow to overcome the need for some people to measure their own popularity simply as the number of people that they can list as friends on their Facebook page.

It follows that there may be a need for a new definition of privacy that is in keeping with the web and its ability to display images and opinion in an unregulated manner. This needs to embrace past concerns about the ability of an individual to live without the threat of others being able to watch them whilst offering some protection from random postings about them online. Perhaps this could include a right to be able to edit or remove anything relating to themselves on the Web, including images that are not news-worthy. The ownership of image rights may be an associated issue that needs to be addressed, especially as modern technology can remove an individual from a group (or a background) view, provide digital touch-up or air-brushing, and then republish it in a different context. However, there is general agreement that personal information (such as contact details and bank codes) should not have a place on the web. Surprisingly few people take proactive measures to prevent tracking functions being activated.

It follows that too much privacy could lead to younger people fearing that they may become lost in a digital world. It is not surprising then that they are prepared to make lots of personal information available, often with no fear of how it might be used by others. When Google glasses and similar technologies become available during the next few years, they will have the potential to identify a stranger walking down the street, and to find many of their secrets to present to the wearer in a fraction of a second. They could know more about them than their genuine friends know - so who will be their friends in the future?

3.6 Data sharing and protection

By 'data sharing' we mean the disclosure of data held by one organisation on an individual to a third party organisation(s), or the sharing of data between different parts of an organisation. Some data sharing doesn't involve personal data because it has been anonymised in such a way that the statistics can be used for the collective good without the identification of the individual. The Data Protection Act (DPA) is in place to provide a legal

framework that ensures that organisations that hold personal data must act responsibly at all times. These principles adequately describe the position of public and government bodies, especially social services departments, who are responsible for the information concerning the health and well-being of individuals - and hence, by implication, the sensitive data relating to their vulnerability.

The legal framework that applies to private and third sector organisations differs from that which applies to public sector organisations, which may only act within the defined limits of their statutory powers. However, all bodies must comply fully with the data protection principles and this situation is unlikely to change within the next 10 to 15 years. In some private sector contexts there are legal constraints on the disclosure of personal data. However, most private and third sector organisations have a general ability to share information provided this does not breach the DPA or any other law. It is advisable for a company to check its constitutional documents, such as its memorandum and articles of association, to make sure there are no restrictions that would prevent it from sharing personal data in a particular context. The type of data held is therefore a subject of concern as it may be difficult for legislation to keep up with the additional layers of data created on-line and through the Internet of Things.

Private and third sector organisations should have regard to any industry-specific regulation or guidance about handling individuals' information as this may affect the organisation's ability to share information. They should also be aware of the legal issues that can arise when sharing personal data with public sector bodies. This becomes more of an issue as private and third sector bodies are carrying out a wider range of traditionally public sector functions. Opportunities for inappropriate sharing of sensitive data will therefore inevitably increase.

Public authorities must comply with the Human Rights Act (HRA) legislation in the performance of their functions. The HRA also applies to organisations in the private sector insofar as they carry out functions of a public nature, which could include delivering a social care activity. Where the HRA applies, organisations must not act in a way that would be incompatible with rights under the European Convention on Human Rights. Article 8 of the Convention, giving everyone the right to respect for their private and family life, their home and their correspondence, is especially relevant to sharing personal data. If personal data is disclosed or shared in ways that comply with the DPA, the sharing or disclosure of that information is also likely to comply with the HRA. The problem may still be in policing the Acts and the rights of an individual if they believe that their personal data has been shared or accessed by an inappropriate organisation or individual.

A legal industry may be born to deal with such matters, but this is unlikely to benefit people who cannot afford the fees involved. They would require either legal aid or to employ more 'no win no fee' companies. Public attitudes to such costs might become negative unless they prove successful in preventing breaches of data security. There may need to be legislation to provide a stronger basis for forcing compliance with privacy laws.

3.7 Connecting with people

We are social creatures; most of us rely on our friendships and interactions with friends and families to share our happiest moments and experiences. Research suggests that this happiness is infectious at all levels and leads to a 15% increase in the happiness of a close contact, 10% for a second degree contact such as the friend's spouse and a 6% increase for a friend of a friend. It is hardly surprising that the success of social media such as Facebook is intimately related to the ability of people to quickly share their happiest moments with as many of their friends and connections as possible.

All this has happened during the rise of the Internet and the corresponding increase in opportunities for connecting online i.e. this is a 21st Century phenomenon which has been facilitated by Information and Communications Technology. But the Internet remains in its infancy and we are only beginning to understand and exploit its potential. In terms of accessing the Internet, there are now perhaps two billion people who have access, with 99% of them having gained this during the past decade. This number will have doubled by the period 2020 to 2025. It is likely that everyone who wants to be connected in the UK will by then be connected. Turning this on its head, only those who don't want to be online will not be on the Internet within a decade. Connecting with the unconnected will therefore be a case of identifying those people who don't want to be found; unfortunately these may include many people who need the support of social care organisations. It means that they will be looking for support only when they are in crisis unless other ways of finding and/or monitoring them are found.

While the number of people connected via the Internet has exploded, this might be dwarfed by the number of connected 'things'. During 2009, the number of things connected to the Internet surpassed the number of connected people, at which point we began to experience what this report has described as the 'Internet of Things'. Yet, 99% of all physical objects that could join this network are not yet connected but the number could grow by 25% every year for the next decade so that there could be 100 billion connected objects by 2025, some of which will be owned or used by everyone in the UK, including those people who don't want to be connected themselves. We will then have an Internet of Everything which will be the smart connection of people, data, events and actions.

With each new person, object, or data that comes online, the connection possibilities between all these elements grows exponentially. The rise of big data, mobile networking, cloud storage and data mining technologies will all play a critical role in the Internet of Everything. The result will be new capabilities, richer experiences, and unprecedented value for individuals, businesses, communities and countries everywhere. The 'network effect' of the Internet of Everything will be a very powerful thing, the true impact of which we won't fully understand for several years. As it develops, however, those who are not connected will feel even more digitally and socially excluded. There will be a need to reach out to vulnerable people unless the process of claiming requires proof of online identity, and the payments to be received can only be redeemed using a chipped card or a downloaded app onto a smartphone. This is, of course, the way that welfare arrangements are already developing; thus, it might prove impossible to make a successful claim without

already being connected to 'the system' either through an online presence or through the Internet of Things.

3.8 Downloading everything

Sixty years ago, information was discovered by reading books, often in a library, where notes had to be made because the books or journals couldn't be removed. Then, in the early 1960s, the first office photocopying machines were introduced into the UK; they immediately meant that pages or articles from books could be copied and taken away to be read and summarised later. Within a few years, photocopying became a replacement for reading as researchers became less adept at selecting a few sentences and every desk became a depository for reams of printed paper. Paper became the means of recording everything from bank statements through to music.

We now appreciate that printing everything is a waste of both the ink (or toner) used to create the black print and of paper, which requires trees to be chopped down and pulped before it can be pressed into thin sheets. Saving paper is therefore seen as green, and good for the planet. Fortunately, we no longer need to print everything because computer memory is unlimited, thanks to the cloud, and we can then view pages and articles on portable or fixed screens.

The internet has everything, and it is all available instantly for downloading, providing there is a device available to accept it, and there is sufficient communication bandwidth to perform the transfer of data sufficiently quickly. Thus, we can record all text articles that are relevant to us, including digital records of birth certificates, qualifications and passports, and the need for original printed versions will decline. But we can also do this for photographs. Most handheld computing devices include at least one camera, so they can generate enormous number of pictures which can be kept for posterity without having to consume inks and special papers to print them.

But the materials that can be downloaded don't stop at pictures; software is available that can grab TV shows after they air and movies as soon as they're released. In the same way, it is possible to schedule music, comic books, video games, and practically anything else as a download with minimal effort. People will need enormous hard drives if they want their own digital copies of these files, so will more than likely make use of cloud storage that will be available from many organisations. The location of the servers may become sensitive due to border restrictions, as will the security of the data and the way that it is backed up so that it is resilient to failures.

It may be evident that application forms for all types of welfare payment will be available only for downloading so that, once digitised, they can be processed by computer and records sent to various servers for subsequent storage and processing. Some people may want to keep their data on them once it has been downloaded. Pen drives can already hold several GB of data, so it is likely that people will be able to carry their downloaded data with them at all times, irrespective of the size and complexities of the information.

3.9 Health and well-being

The general health of the population is unlikely to deteriorate noticeably within 10 to 20 years. Indeed, expectations of the population are that things must improve as surgical techniques mature and as pharmaceutical interventions become more personalised and powerful. However, the rising demand for health services due to an ageing population, and the increasing cost of providing sophisticated therapies will make delivering a free and universal health service difficult without substantial increases in taxation. This is unlikely to happen in the UK, even though spending on health services will be protected against the cuts facing other services.

There will have to be changes in how the NHS works. For twenty years, hospitals have been closed and replaced by fewer new facilities so that the bed count is reduced. This has led to a significant shift in resources to primary care and community care, supporting shorter stays in hospital and speedier transfer back home for people after surgery or illness. This has been successful, but there remain problems with demand for GP services, especially out-of-hours and at weekends. Indeed, despite the introduction of NHS24 and similar help-lines, the demand for GP appointments continues to increase. Delays are inevitable and this will increase system failures, with more unnecessary deaths and a failure for people to access a diagnosis that might lead to early interventions and, ultimately, lower delivery costs. Over 250 more patients are added to waiting lists every day.

This will lead to a new model of primary care, consistent with existing changes which have seen surgeries move from High Street locations to medical centres close to bus routes and with more parking for patients. The process of making an appointment is changing from a telephone-based interview process dominated by a medically-unqualified receptionist to a choose and book approach using an online process linked to electronic patient records. This will give patients more convenience, but will allow priority for those who have Internet access at the expensive of those who are digitally excluded. Making the process of booking an appointment quick and easy may also increase demand from people who do not need to be seen as it will fail to identify those in greatest need.

A greater use of telehealth and telecare technologies will be inevitable, beginning with the first contact as an encounter using the telephone, e-mail or video conferencing - a visit to the GP surgery should be a last resort, and should involve a nurse consultation in the first instance. This would be consistent with three quarters of appointments currently involving a chronic disease or long term condition which relates to improved self-care. The support of these patients at home should be prioritised through tele- and web-based technologies and should involve training and coaching through a network of nurse practitioners. Home visits should generally be unnecessary through the use of these technologies but could be supplemented by satellite surgeries manned by nursing in community premises or in pharmacies, nurseries and Internet cafes.

The homes of people who need closer monitoring can then become part of virtual wards, with real or electronic visits by health professionals. University Hospital Southampton NHS Foundation Trust already looks after patients who have undergone surgery such as a hip or knee replacements in virtual wards, with high levels of satisfaction. The Royal Free London

NHS Foundation Trust offers a similar service but plans to add the possibility of video consultations between patient and consultant.

3.10 Attitudes to public health issues – obesity, smoking, alcohol abuse, drugs

As self-care becomes the focus of the NHS, the public will increasingly understand that the costs and availability of services are being harmed by the poor health behaviour of relatively small numbers of people. The link between public health initiatives today and healthcare needs and costs in the future will become increasingly evident as a result of the way that information is presented. Thus, the overweight smoker who currently attracts concern and pity when they are diagnosed with diabetes and COPD is increasingly being seen as the victim of their own stupidity or lack of self-discipline. If they continue to neglect medical advice and continue with an unhealthy lifestyle then the way that they receive treatment and consume resources will become a matter for the entire population.

Obesity is seen as due to a combination of poor diet and a sedentary lifestyle. No longer is the idea that people are 'big boned' acceptable. Governments will respond initially by requiring manufacturers and food processors to provide nutritional information on packaging, and on menus in restaurants. But people can choose not to read the data and to neglect both the importance of food quality, content and quantity. This will increase pressure to introduce fat or sugar taxes and these are likely to be in force within a decade.

Although the high taxes on tobacco products has forced some smokers to reduce their consumption or to give up altogether, the impact has been reduced by the smuggling of products from overseas, and by the availability of duty-free cigarettes for people returning from foreign holidays and business meetings. Further measures are planned to change packaging and to include even more graphic images and warnings on cigarette packages, to make smokers aware of the effects of smoking on their health and well-being. There is, as yet, little evidence of how successful this might be. More effective has been the banning of smoking in public places, including trains and aircraft. Expensive medical interventions such as heart transplants will be denied to individuals until they change their lifestyle behaviour. Smokers might therefore be increasingly ostracised, leading to a loss of esteem. This may have a particular impact on people who already suffer from mental health problems who are more likely to smoke.

The overuse of alcohol is being recognised as a major factor in hospital admissions, with NHS figures showing an increase of over 40% in such admissions over the past decade. Linked to this has been a 75% increase in prescriptions to treat alcohol dependency. Few people have sympathy for those who waste their limited income on booze. If they have children or other dependents, they will be the ones who suffer, and who may need the support of social care.

Drug users are already significant users of social services as their habit is likely to make them unemployable. They receive little sympathy from the general public because they are seen as criminals and people who waste public resources. Levels of drug abuse have been

slowly increasing over the years but this trend is slowly being reversed. Indeed, the number of people using drugs during the past year has fallen to its lowest level for nearly 20 years (below 9%), with cannabis being most likely, often following excessive drinking. As electronic noses and other technologies can detect traces of drugs, it seems likely that success in overcoming addiction can be measured objectively. This may become a two-edged sword, rewarding those who can turn around their lives but further marginalising those who can't or wont accept the 'cold turkey'.

3.11 Attitudes to surveillance

Issues associated with privacy, confidentiality and data security have been discussed previously in the context of information technology, the World Wide Web and the ease of collecting, recording, recalling, analysing and displaying data. The monitoring of individuals and their methods of using this information can be regarded as surveillance. As the quantities of data increase, along with the number of devices that can be used to access it, the surveillance tools will also increase in their sophistication. Indeed, the Big Data approaches described in the previous section will enable the combination of structured data (such as the information held in databases) to be married with unstructured data from images in such a way that it can be mined.

Whilst the 'digital surveillance' methods described above may cause most concern to people because of its impact on anonymity, it is the collection and analysis of images that are the major concern to people as they contemplate the ways that 'Big Brother' may develop to restrict freedom. Every major UK city and town centre has an array of CCTV cameras that continually record activities from every angle. If it used to be true that nobody in London was more than 10 yards from a rat, it is certainly the case today that nobody can be more than this distance from being in view of a surveillance camera. Yet, they receive so much positive publicity from TV programmes where their footage is used to detect vehicles close to a crime scene or to monitor the movements of suspects, that they are now accepted by the public as a deterrent in the same way as 'bobbies on the beat' were seen 25 years ago. There is therefore little public reaction to the expansion in the use of video surveillance except for the practical observation of how so many views can be inspected and recorded.

Looking to the future, the tumbling cost of video technology will surely lead to another increase in the number of devices. The aerial views taken from towers will be supplemented by more local views taken by devices that are embedded in the fabric of buildings or carried by individuals either on their person (for example on clothing or spectacles) or in the bags that they carry. The time and date-stamped images, as Big Data, will be recorded to 'the Cloud' where it can be added to other data. It can then be used when an incident has occurred or to provide further detail of night-time activities.

It follows that there will be no hiding place for people who simply want to disappear. They may respond by wearing clothing (such as hoodies) that hide their faces or which make it difficult to distinguish gait or mannerisms from which they might be identified. New forms

of clothing may be designed to make shapes more difficult to analyse, and these might become the uniforms of a class of person who wants to live in a way that they don't interact with officials from any ministry or local government department. If they also obstruct services then they will be considered to be anarchists of some form, sparking protests from other sectors of society.

3.12 Attitudes to driving

Motor cars have been a feature of UK roads for over a century, but it is only during the past 50 years that they have become a resource that most families have had access to, enabling them to travel without the restrictions imposed by a limited railway network and non-integrated bus transport. People who have had a car throughout their lives often see their cars as an important factor in enabling them to remain independent and to exercise choices relating to where they shop and where they spend their leisure time. This extends to their spouse and to friends and neighbours that they might take with them on their various expeditions.

Unfortunately, there are incidents involving older drivers who perhaps go down a motorway in the wrong direction, who are taken ill at the wheel, or who are involved in an accident involving no other vehicles. These are small in number but often lead to a reaction that they shouldn't be allowed to drive 'at their age'. Age itself is not an indicator of driving quality but because old age also brings more chance of having limited long term conditions and other illnesses, it is easy to make a link between driving ability and age. The licensing system does require continued driving to be linked with medical advice, and forbids people with poor eyesight, epilepsy and other conditions to hold a licence in old age.

Yet statistically, older drivers cause far fewer accidents than younger drivers. The reasons for this may be complex and are likely to include the fact that they drive less often, cover shorter distances and don't go out in the dark or in poor weather. However, it does not wholly explain why the UK's drivers aged over 70 and who represent some 8% of all drivers are involved in only 4% of accidents that cause injury. This compares favourably with the 15% of drivers aged between 17 and 29 who are involved in over a third of crashes that result in injury.

By 2020, the number of drivers aged over 70 on UK roads is likely to increase to over 7 million. This will require a new national strategy perhaps involving support for older drivers, further training, raising awareness of issues and making more use of adaptive technologies to support the driver in avoiding collision or forgetting to check on the status of their vehicle. Poor eyesight could be enhanced by camera technologies rather than forcing people off the road if they are unable to read a licence plate.

The International Longevity Centre has found that one in four Britons thought drivers should be made to switch off the ignition for good somewhere between the ages of 70 and 75. The numbers may decrease as the population ages and as cars become safer. Forcing

older people off the road may be a natural consequence of providing free bus passes and subsidised rail fares, but the growth in the pavement scooter industry demonstrates that older people value their independence and will do almost anything to get out and about. Perhaps legislation will result in more regulation of electric vehicles and where they can travel.

There can be no doubt that getting out will be associated with better quality of life and well-being, and this is likely to be supported in the future as evidence of improved outcomes emerges. It is to be hoped that positive stories will be publicised so that public attitudes aren't hardened. This may be supported by more in-car monitoring of drivers and the linking of performance with on-line driving records and licences. These could, through remotely monitored ignition systems, prevent the use of motor vehicles by people without a licence or without insurance.

3.13 Climate change

There is a general view that the emissions of carbon gases are contributing to global warming in a manner that will change the UK climate in such a way that the climate may become more Mediterranean. However, some scientists believe that man's impact on the environment may be small compared with natural variations caused, for example, by cyclical changes in the sun's energy output or by the effects of volcanoes and earthquakes. Recent evidence has suggested that we are going through a phase of changing extremes and that this is more likely to cause storms, periods of excessive rainfall and unusual seasonal trends with snow and frost in the spring and warmer winters. Considerable uncertainty remains and it might be necessary to plan for a number of different scenarios, and for the impact on vulnerable people.

I. Colder winters: UK properties are poorly insulated, resulting in excess mortalities during cold spells due to an increased number of people suffering from stroke as well as bronchitis and other pulmonary diseases. The cost of heating continues to increase, putting more households into a state of fuel poverty. Any further cooling during the winter months will result in more people living in unhealthy cold conditions. Winter fuel payments are likely to be restricted to the poorest people, but this might exclude people who live in larger properties that are more difficult to heat.
II. More storms: excessive winds and rain can cause flooding at any time of the year. Many UK communities are built close to rivers and these can surge during heavy rainfall, causing houses to be filled with water and furniture and carpets lost. Insurance can be problematic for properties built on flood plains which can blight properties and prevent owners from being able to sell and move on. High winds can rip off roofs, causing injury and also causing families to be left homeless and dependent on social services.
III. Hot summers: Europe suffered high temperatures during the summers of 2003 and 2004, leading to heat stroke and hypothermia. The UK has not previously suffered from such problems but might be expected to experience days of extreme

temperature and humidity at times. Older people may not be prepared for such weather. Street dwellers may be unable to find shade and supplies of drinking water.

Irrespective of what combination of weather scenarios arise, it must be concluded that any extremes will have a major negative impact on vulnerable people, especially if they are not prepared because they haven't received the weather warnings and advice that can be broadcast using the TV, radio and online services. Once again, the digitally excluded will suffer and will pay a high cost. Society will continue to pick up the bill in terms of demands on social care services unless preventive actions are taken in the form of connecting these people to each other and to formal services.

CONCLUSIONS

It may be apparent from both the technology views, and from the discussions about how external factors may change the face of social care, that the dominant factors for change will be access to online information and communication. No longer will a digital presence be an advantage that will be used exclusively by the well-educated and articulate, but it will be a facility that will be available to everyone and in all places. This leads to an assumption that the people who are likely to be most vulnerable in the future are those who are digitally excluded for whatever reason. Social workers will therefore find themselves dealing with people who are unable to do things for themselves because they cannot access important information, or who need help in using this information to overcome the problems that presents to them.

All cases are unique, but there are a number of groups of people whose needs should be addressed in order to show how social workers will need to be trained to satisfy future support needs:

- Older frail people who need physical support to perform activities of daily living
- People with cognitive impairments such as memory loss who present safety problems
- Those who are socially excluded and who have little social capital
- Visually impaired people and those with other sensory disabilities such as hearing loss
- Adults with learning or developmental disabilities who want to live independently
- People with serious illnesses who are approaching the end of their life
- Physically disabled people who are unable to transfer without help
- Victims of domestic violence and their families, and
- Informal carers who are supporting any or all of the above.

Technologies that directly support the groups described above are all either available already, or will soon be available and at a price that makes them affordable. The price of independence is therefore falling as a result of technology. Many of these developments are examples of assistive technologies or of connected technologies that ensure that people are not alone, however isolated they might be in a physical sense. Social services can therefore refer people to more specialist service providers and will need to commission services that meet defined needs. The two major challenges that they face will be:

(a) Being aware of all the new technologies that are available - and ensuring that their knowledge is up-to-date when items can become redundant within two or three years, and
(b) Persuading the public that technology is reliable and an appropriate and affordable means of supporting independence.

The former problem is to do with training and ensuring that databases of products are available online and in a form that can easily be searched. Advice must be impartial and should be rather more sophisticated than a simple comparison website as used for standard items such as home insurance. The latter problem is the same one faced by health chiefs as

they try to persuade people that fewer hospitals and less beds is the way forward for the NHS at a time when the population is ageing and demand for healthcare services is increasing rapidly. It will require political resolve as well as the promotion of many favourable examples of benefits in order to demonstrate that genuinely good outcomes can be achieved by putting more faith in technology.

The Whole System Demonstrator studies undertaken in Cornwall, parts of Kent and in the London Borough of Newham have proved that the telehealth systems can reduce the demands of an ageing and chronically ill population on the NHS in a safe and popular manner. They did not show the value for money that the UK government had hoped, though this was, in part, a result of the costs involved in setting up such a research programme, but also because the equipment and service costs demanded by the suppliers were too high. This has forced down prices and will have a future positive effect on the AT industry as it will convince them that the way to maximise benefits and reduce stigma will be to employ standard items as often as possible and to ensure that designs are universal. This supports the idea of using existing hardware items in more flexible ways, especially where apps can be imported to change the function of a device. These will benefit people with sight problems and with hearing problems because walking around with a smart phone in the hand is now common practice for all users - and especially for the 'cool' younger users that they might wish to emulate. Of course, there could be unexpected consequences. In the case of the visually impaired, will they need to learn braille when their cameras can read text and their software and read it out aloud? What happens to those social workers who have studied for years to learn and to teach braille? Similarly, will hearing aid manufacturers and assessors be needed when an app can perform the test and optimise the performance of the amplification needed? Will devices become redundant because people will have noise eliminating headphones that extract the desired speech or music from the background?

The other questions that need to be asked will be:

- Who pays for the technology?
- Who maintains it and provides support for it? and
- How can it be provided to service users?

The answer to all these questions is relatively simple - the service users themselves using personal budgets. The culture of self-directed support must evolve such that it is no longer just about paying for a person to do things for the individual, but about buying a defined service. This is an opportunity for new service providers to emerge where they know the technologies and can set up cost-effective online services that include access to broadband, the portable (and fixed) devices needed to display and communicate, the training to show how it works, and the ongoing support that will respond to problems in the fastest possible way. If people are to depend on their technology services, then their support structures must be sufficiently responsive to ensure that they have the confidence to know exactly what to do in the event of failure. By 2020 the requirements for such services will be well-defined, and there will be countless services able to support social care users in this way. This will, in part, be due to the improving quality of all technologies - how often do TVs, cars and fridges break down today compared with 20 years ago? But it will also be due to the

fact that electronic products have no moving parts any more - and are also becoming so low cost that they are almost disposable. They won't be thrown away - but they will be replaced by new devices that can be programmed immediately using cloud storage.

APPENDIX A

These 20 short vignettes offer the opportunity to think about how quality of life may depend on receiving adequate and appropriate technology-based services. Appendix B illustrates how these might be used to explore the ideas suggested in this report.

1. William Johnson - ex soldier. Aged 68, divorced, lost contact with 2 children. Drinks heavily. Newly diagnosed with Type 2 diabetes.
2. Gillian McAndrew - aged 82. Widowed, with 2 children and 6 grandchildren. Is suffering from AMD and is slowly losing her sight.
3. George Brown - aged 72. A former drummer in a successful 1960s rock band. Smoked cannabis for many years. Has lost significant hearing and short term memory but won't wear a hearing aid.
4. Janice Wallace - aged 75. Married to husband William for 50 years. Has developed short term memory loss over past 2 or 3 years. Probably has Alzheimers but has not been formally diagnosed.
5. Grace McNulty - aged 82. Very independent spinster who has very painful arthritis which is having a significant negative impact on her quality of life as it is limiting her ability to go out and to go upstairs in her semi-detached home.
6. Jeremy and Joanna Baxter - a couple in their early 50s who have become sandwich generation carers. Jeremy's mother lives 200 miles away in a retirement housing scheme but he is her only son. Joanna's mother lives 5 miles away and has become dependent on her for shipping, taking her to health appointment and for generally support which is increasing. They married relatively late in life and have 2 children, John and Ian aged 20 and 15 respectively. Ian has Down's syndrome and lives with them. He is also epileptic though the number of seizures that he suffers during the day is now quite small.
7. Jennifer is aged 12 and has Asperger's syndrome.
8. Susan McKenzie is aged 35 and has bipolar disorder. She has a daughter aged 10 who lives with her but who is on the at-risk register because of her mother's bipolar disorder.
9. Jeremy Steele is 45 years of age and has severe memory issues and mobility problems since suffering a motor-bike accident in 2009.
10. Joyce Stewart is 78 and, following the death of her husband last year, is surviving on her basic retirement pension. She has no children, feels lonely and isolated and incapable of paying her bills or organising her life.
11. Sandra Smith aged 18. She has a learning disability and lives with her parents. She has attended college for the past few years but ends her time there in the summer. She has been offered a job in a local museum and would love to move into her own tenancy in order to become independent. She has a boyfriend and dreams of getting married and having a family.

12. Nora Black lives alone in a small terraced house. She suffered a stroke 3 years ago which has left her feeling anxious and with slurred speech. She has been the victim of doorstep abuse and is fearful of being robbed again though she has little of value to steal.
13. Elvis Roberts is aged 75 and has spent most of his life in and out of prison for various petty offences mainly involving the handling of stolen goods which he tried to fence through companies that he set up. He was declared bankrupt last year and therefore cannot have a bank account.
14. Pauline Wilkinson lives for her cats and her dog. She has been in hospital for a hip replacement and needs support looking after her pets. She lives in a 2nd floor apartment.
15. Alice Wilson She has 4 children and is struggling to support them since her latest boyfriend walked out on her and the kids (only one of which is his). She has no qualifications but has claimed some disability benefits after suffering from back pain during one of her pregnancies. The outlook for her and her family is bleak, especially as life on the housing estate in which she lives is bleak and is driving her children towards crime.
16. Elizabeth Cameron – aged 88 prone to falling. Unlikely to wear any special devices that stigmatised her. Yet, she has plenty of money which she would use to put things into her house if they could make her safe there.
17. Fiona Jones – aged 36 and mother of 3 children aged between 6 and 11. She has suffered physical abuse at the hands of a new partner for the past 3 years and has recently taken up residence in a refuge.
18. Geraldine Reynolds, aged 82, is a rather frail widow who lives in a detached house in a high class residential are of Edinburgh. She is relatively wealthy as a result of being careful with the money earned by her domineering husband. Her 3 children live in the Lothian area but they and the grandchildren only visit her when they want something. Issues of financial abuse abound concerning both her family and the friend who helps Geraldine to perform shopping and other domestic tasks.
19. Jacqueline Baxter, aged 63. A spinster who retired recently after a long career as a primary school teacher. Feels the cold badly because of Raynaud's syndrome which prevents her from using a mobile phone and a touch screen computer or tablet. She worries about going out in the cold, the cost of heating and the loss of friends because she can't communicate with them using Facebook and social media.
20. Jane Doe - she was found in a park in Aberdeen with a fractured ankle and suffering from mild hypothermia. She claims that she can't remember her name or where she lives. Her age and appearance suggest that she may be living on the streets. Her accent is English rather than Scottish.

Fuller details for each of these vignettes are available.

APPENDIX B Technology-enabled care in practice

Using six of the above vignettes, we illustrate how various technologies might play a part in delivering better outcomes.

William Johnson, an ex-soldier aged 68, divorced, and lost contact with his 2 children. Drinks heavily and admitted to hospital several times – after a bout of drinking. Newly diagnosed with Type 2 diabetes.

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
William is not old, but he has bee stuck in a rut with few interests and little social capital for a number of years. It is not surprising that he has taken to using drink as a method of blocki out the emptiness of his existenc The impact of years of drinking o his liver will eventually kill him, b his current issue is with diabetes which will affect all his internal organs, along with his circulation unless it is managed. This require discipline, which he should be ab to manage following his military background. However, it is more likely that he will not measure hi blood sugar levels, he will not giv up foods that are high in sugar, and he will not exercise to impro his health. His glycaemic control will be poor leaving him even mo susceptible to falls, accidents and admissions to hospital. With no motivation, he will either develo diabetic ulcers which could lead t amputation, or he will suffer a failure of his liver or kidneys. He will die a relatively young man, unhappy and alone. His condition will cost the NHS thousands of pounds in use of hospital beds, a might also cost the social service budget a similar sum in residenti	William needs to be connected firstly to the communi and then to a new generation of friends and family so that he can widen his range of interests and access to the services that will exist to support him. If he hasn't already been shown how to use a computer then he needs to take advantage of a scheme that uses volunteers - and these might include ex-military personnel who will be keen to help one of their own. He will have many options to getting online including the use of a smart TV and a smart phone. The TV optic could then become the basis of an online chat room using video conferencing, and allowing him to meet u in virtual meetings with some of his old colleagues fro the army. This could lead to physical reunions and opportunities to share in activities designed specifical to overcome the emotional problems that are found i many ex-military people once they retire. Although he has lost contact with his children, they w have an online presence which will enable him to find them. They might be prepared to give him another chance and to introduce him to their children, none o whom will have negative memories of him. Grandchildren may give him some meaning for life, especially if he asks for pictures and gives them gifts a Christmas and on their birthdays. William's health issues will also be of interest to his children. People will recognise the importance of inherited genes and will realise that they can learn a l about their future health issues by talking to the provider of the other half of their gene pool. This coul give them a greater understanding of the hereditary factors associated with diabetes and will teach them best practice in prevention. They may support their father and encourage him to take up Cognitive

care home fees, especially if he requires an amputation.	Behavioural Therapies to tackle his alcohol demons, especially as they can now be delivered remotely via the smartphone that they might buy him. This device runs apps to remind him to measure his blood sugar level, to take his medication, to manage his diet, and t take more exercise. William will be a different man a will have a quality of life that makes him feel better as person.

Jeremy and Joanna Baxter - a couple in their early 50s who have become sandwich generation carers. Jeremy's mother lives 200 miles away in a retirement housing scheme.

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
Jeremy and Joanna are struggling with their consciences as they try to support their mothers and the sons. They will want to ensure th their younger son Ian is given every opportunity to maximise hi independence but, having looked after him well and closely for the past 15 years, are finding it diffic to understand his ambitions. Although he hasn't had a seizure for many years, they insist on leaving all bedrooms doors open night so that one of them could react quickly if they were awoke by his convulsions. Meanwhile, their older son may feel neglecte at an important stage of his life, especially if his parents are being pulled one way and another by h grandparents. If their marriage h been weaker, then the pressures might well have broken it but the share their love of their family ar take their responsibilities very seriously. Nevertheless, their health is suffering under the continuous burden of care. Joanr gave up her shop assistant job to look after her mother but is	Ian is digitally engaged and loves his Android phone, tablet and laptop. He engages with his friends every evening through his smart media, enabling him to participate in all their social activities. He has used his self-directed care budget to buy himself an epileptic seizure detection system that is portable and based o his smartphone. His parents can now sleep well in the knowledge that their vibrating pillow device will alert them if he has a convulsive seizure during the night. The seizure detection system is entirely portable whic means that his telecare system can go with him if he chooses to spend the night away with his friends, givi his parents regular respite opportunities. The idea of him moving out at 18 is no longer so frightening for them. The system works so well that Ian is able to suggest th his parents provide similar telecare facilities for his grandmothers. They are able to choose different systems for the two women. Jeremy's mother can return home with monitoring of her cardiac output being provided remotely to her primary carer while sh is bed, and through a variety of connected technologi that populate her GP health record. Jeremy is able to connect to her with a Skype system while her social landlord ensures that any emergency needs are relaye to him using a telecare systems. She is empowered to use online shopping through her local Tesco store. Joanna's mother is making good progress following he stroke. She uses a Kinnect system for rehabilitation exercises and has regained much of her function.

becoming depressed as she misse meeting all the people who came into the shop. Jeremy was made redundant and feels guilty that h cannot support them financially and that he is unable to provide a much hands-on care as his wife c pay for them to have a holiday. Ia continues to live with them after leaving college at 18 even though many of his friends have moved into their own tenancies. John leaves university and accepts a volunteer job in India. His parent hope that he might phone at Xma	Joanna monitors her using a second generation teleca system that alerts her if movement levels have decline or if her mother hasn't gone to bed by midnight. The system delivers alerts to Joanna's phone which means that she is able to go out without worrying about her mother's well-being. She has been able to restart her part-time job. Jeremy has decided that he can now retire. He has a couple of new hobbies but also volunteers for a local charity, showing other retired men how to use a computer. He has also made some money by selling furniture that he made in his shed on eBay. He and Joanna will be visiting their son John in India who speaks to them every week using Skype. They had invited Ian but he has declined as he wants to go on a camping holiday with his new girlfriend. He has a job i a hotel and plans to visit John independently next yea

Jennifer - she is the 12 year old daughter of a young single mother, and has been diagnosed with Asperger's syndrome

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
Jennifer's mother, Mary, has struggled since the birth of her daughter, and has received little support from family or friends. Sl has become a loner and her who life revolves around her daughte Unfortunately, Jennifer lacks bot social skills and access to learning materials that might help to exercise her brilliant analytical mind. She is limited to the television and the channels that can be viewed without subscription. In the same way, sh is not exposed to fiction and has few opportunities to develop her imagination. She will have to change schools frequently becau of bullying and her mother's desi to avoid her getting too close to any friends. This limits her ambition and, ultimately, her performance. Some of her	Jennifer's needs are identified, enabling her to receive special attention so that she can receive cognitive therapies to help her to deal with her medical problems. She is allocated a personal budget to enabl her to buy technology services to support her. These fund a number of digital devices and a fast broadband connection which enables Jennifer and her mother to gain an online presence. She buys a new watch with GPS and mobile phone facility and a 3G tablet device for her mother. It means that Jennifer can go off without Mary worrying where she is because she knov that she has the means to locate her. Mary has no fear of the digital world because in it an individual isn't judged by the clothes that they wear, the food that they eat and the money that they have i the bank. She uses the technology to develop an onlir presence through a Facebook account on which she publishes pictures of Jennifer. Her family find her and make contact. Before agreeing to see them, she is abl to check them out, find where they live, see pictures o their homes using Google Map and Street. She is no longer at a disadvantage and is able to apply for a job a sales assistant in a clothing store where she can get

classmates will gain scholarships excellent universities while Jennifer will go to the local technical college where she will excel but end up in a mundane jo which she will hate. She may find happiness if she meets a nice young man who appreciates her intelligence and technical knowledge. If she does, it will shatter her mother's fragile confidence, and lead to a situatio where she must choose between her boyfriend and her mother. When she moves out of her mother's home, Mary suffers a breakdown, and is committed for her own safety. She ends her day in a community care placement praying that Jennifer will call.	25% discount on items for herself and for her daughte Jennifer's mathematical and computing skills put her i the top 2% of people of her age. She understands that she is different and decides to find out more by recruiting other people with the same condition through her own Facebook account. She sets up chat-rooms and mutual support groups. As a project, befor going on to university, she writes a number of apps th enable people with Asperger's to share their experiences and to seek help from the community. She wins a scholarship to university and, during the summer break before her first term, they co-author a book on how digital inclusion helped them to overcon the problems of social exclusion that were triggered b disability and single parenthood. Jennifer may not hav all the social skills, but she understands how she shou behave. She also understands that she's an individual and can behave how she wants to.

Susan McKenzie – a 35 year old who was diagnosed with bipolar disorder 8 years ago and who is now struggling to care for her 10 year old daughter

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
Susan carries the label of 'menta ill' and is monitored by social services staff on a regular basis s that both she and her daughter a safe and well. She has little conta with her family and her records a incomplete because of her previous attempts at becoming lost in the system. Although she i normally lucid and responsible, h history suggests that she cannot trusted to self-medicate. Her daughter would be at risk in the event of a depression and managing this risk is the priority the social work team. Because her condition varies so significantly over time, the suppo she receives tends to be generall	The mental health problems of Susan can be managed by medication if she becomes compliant with her GP's prescriptions. She may be provided with an intelligent pill reminder and dispensing device which alerts her t take her medication at the appropriate time. The system prevents her from overdosing and requires he to use a tablet computing device to take a photograph of her taking her medication and recording it to the cloud where compliance may be monitored automatically. She becomes fully engaged with the digital world, allowing her to fill in the gaps in her electronic health record. Her medication monitoring system also record her movement and activity patterns which are added her health records to produce Big Data for her which can be analysed in order to predict when she might be feeling positive or negative. The application learns her behaviour and is able to suggest triggers for her bipolar events, such as

low, but with the expectation tha it can be ramped up if her behaviour gives cause for concer In practice, the social work team has few ways of identifying the occasions when Susan is experiencing a high or a low, unless it is reported by her daughter. The result is that she is unable to hold down a job and is therefore always struggling to provide for her daughter, and for herself. During the course of the next few years, she might find herself arrested for performing some stupid act in public, but might equally be at risk of self-harm or suicide during one of her lows. H daughter may stay with her, but could be psychologically damage by her responsibilities and by seeing her mother in extreme states.	temperature changes or poor sleep patterns, in order to predict when her medication needs to be increased or changed. The feedback means that her condition is genuinely under control which makes Susan feel bette in herself. Her daughter no longer feels isolated when her mothe is unwell. She has joined an online support group whi enables her to take out her frustrations without harming her mother. She has learnt how to help her mother through these predictions, and is happy to use these big data apps to fulfil her own requirements of understanding her mother's problems. Her genome h been decoded, enabling her to show that she's not likely to suffer the same mental health problems as he mother but, in order to understand what her mother goes through, she has undertaken an online course in cognitive behavioural therapy. Susan is able to find herself a job, knowing that she is unlikely to let down her employer providing that she takes her medication. Her daughter continues to interact with her mother and to support her in her ambition to remain in employment.

Geraldine Reynolds – an 82 year old relatively wealthy widow who is concerned by the possibility that one or more of her family members is abusing her financially.

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
Geraldine is fortunate that she ha a strong network of friends and neighbours who are available to support her when she has problems. She also benefits from being financially independent an has the means to pay for every service that she might need. Unfortunately, her own children cannot be trusted and would quickly take over responsibility fo her estate if they had a chance - especially if it meant that they could milk her for cash. They hav	There are several types of telecare system available that would provide continuous and automatic monitoring of Geraldine and her home environment. Many of them provide alerts to her (and to her friends if necessary) if there has been a safety or security issu They can include a 24 monitoring centre in the response loop so that in the event of an emergency, a carer, the police or the ambulance service can gain admission to her home using a key held in a key-safe. This means that she no longer has to rely on her famil to hold a key. She can't actually ask for her key to be returned, so she decides to have a camera fitted at th front door. This is linked to her new home network an transmits an image of every caller to a cloud storage

proved to her that they believe each other more than they believ her, and this is a cause of on-goir concern to her. It means that she won't consider any actions that could compromise her independence. Thus, instead of planning to spend her final years surrounded by her family, she is having to live without them as sh sees no other way of ensuring th they don't attempt to take away both her money and her freedom She might consider reporting her concerns to the police and to soc services, but she knows that she has no proof, and they are more likely to recommend to her that she tries to build some bridges so that she has some family support in the future when she might nee it. She also fears that if she finds out definitively that her daughter has been robbing her then it coul lead to either a prosecution, whi she doesn't want, or to one of he children being disowned by the brother and sister's families.	facility which forwards them immediately or on demand to Geraldine's smart phone. She also has a smart TV and can review the images of all callers, all date and time stamped, at her leisure. She takes the opportunity to call them to apologise for being out an to ask what they wanted. They quickly learn that they can't call and enter without invitation, and now ask before calling if it would be convenient. Geraldine tri not to be too flexible because she has developed man new friendships through her online presence. They have advised her that she should set up cameras insid her home too so that she can record what happens when her family members call, especially when they slip out of the living room to go to the bathroom. The have advised her that social services are proactive in dealing with elderly abuse, and have shown her how easy it is to take charge of her situation. Fearing that her condition is likely to decline in the future, she offers to provide her children with 2nd or 3 generation telecare systems that could link them to h over the Internet. Only one of her children takes up th offer, and it gives her great reassurance that he can monitor her well-being. The same system is part of a service that also reminds her to take her medication, put on her spectacles and switch on lights when she gets up to go to the bathroom during the night, and to lock all doors and windows before going to bed. She sleeps safe in the knowledge that an electronic safety net is working alongside her family to keep her independent, and to ensure that she doesn't have to move out of her home in order that she can receive th support that she needs.

Jane Doe - a middle-aged lady who seems to have lost her memory, but who seems to have no home to call her own. She is in crisis after being found with a broken ankle and mild hypothermia.

Today's Possible Outcomes	**Tomorrow's Possible Outcomes through Technology**
Jane is currently at a disadvantag because neither the ambulance service, nor the staff in A&E nor anyone else knows her history ar her family details. Social workers therefore have to take responsibility for providing her	The tests performed on Jane provide a wealth of information that is included on the temporary patient record produced at the hospital where she is taken as an emergency. They are able to use this big data to match her to an electronic patient record of a Linda Wilson who was treated by a GP in London in 2014 fo skin complaint that was an allergic reaction to materia

with a place of safety to which sh can be discharged. They will try their best to find her history and her identity, but without her cooperation and a name and dat of birth, there is little chance of finding her home address and the next of kin details. Consequently, they are obliged to admit her into a residential care home for a sho stay in the hope that her memory will return. Jane makes it clear th she will be on her way as soon as she can walk without help. The social workers are concerned that she has no apparent income and that when she moves on she will live on the streets, despite th cold weather and her lack of war clothing. They look through missing person files but are unab to find anyone who matches her description. Either she has noboc who misses her, or she chose to 'disappear' so long ago that she r longer appears on records. Jane appears unconcerned and is happ to walk out of her temporary hor as soon as her plaster cast has been removed. Social services he no more about her.	used in the factory in which she worked. This information was used to trace her history and to find her family connections. When told about her past, Linda (who responded to the name) admitted that her memory was not impaired but that she didn't want to have anything to do with her family. She admitted tha she had run away from an abusive relationship 20 yea ago and that she was scared of her ex-boyfriend findi her. Social services agreed to pay for her to stay for a coup of weeks in a Bed and Breakfast while they looked into options for her. They also looked into possible benefit that she could claim, and showed her how she might use online facilities to look up her former friends and family. Linda is quite intelligent and quickly learns how to use the Internet and is excited to find that her ex-boyfrien was found guilty of a serious offence and imprisoned for a ten year term the year after she had 'disappeared'. She further found that he had been brutally murdered in an incident involving gang members two years ago. This gave her the confidence to look for her family online - and was thrilled to find that her mother is still alive, and had formed a charity to help find missing children, and that her sister had married and had three young children. She found out where they lived and used social networks to connect with her sister who was thrilled to hear from her. The had a Skype conversation and Linda was persuaded to return to London to see her mother. Before leaving Scotland, she was able to enrol on an I training course and then gain a qualification in computing. She was able to find a job close to her mother and to move in with her.